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Geology of the Ferdinand Lake Area

District of Kenora, Patricia Portion

by
Henry Wallace

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FOREWORD

FERDINAND LAKE AREA

The Ferdinand Lake project was part of a multi-year program to provide detailed, up-to-date information on the geology and mineral potential of the Uchi Subprovince. Although the Ferdinand Lake area itself contains few known mineral occurrences, it was selected for semi-reconnaissance mapping in 1979 to bridge the gap between two areas previously covered by detailed geological surveys, namely, the Birch Lake area to the west and the Slate Falls area to the east. This mapping has allowed long range correlation of volcanic stratigraphy across this central portion of the subprovince. Such knowledge may be of considerable exploration value given the association of base metal deposits in the Confederation Lake area, and gold deposits in the Red Lake area with volcanic rocks of specific ages and chemical affinities.

E.G. Pye
Director
Ontario Geological Survey

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FIGURE

1. Key map for the Ferdinand Lake area vi

GEOLOGICAL MAPS

(back pocket)

Map P.2345 (Revised), (uncoloured), Geological Series, Ferdinand Lake Area (Western Part), District of Kenora (Patricia Portion), scale 1:15 840 or 1 inch to ¼ mile.

Map P.2346 (Revised), (uncoloured), Geological Series, Ferdinand Lake Area (Eastern Part), District of Kenora (Patricia Portion), scale 1:15 840 or 1 inch to ¼ mile.

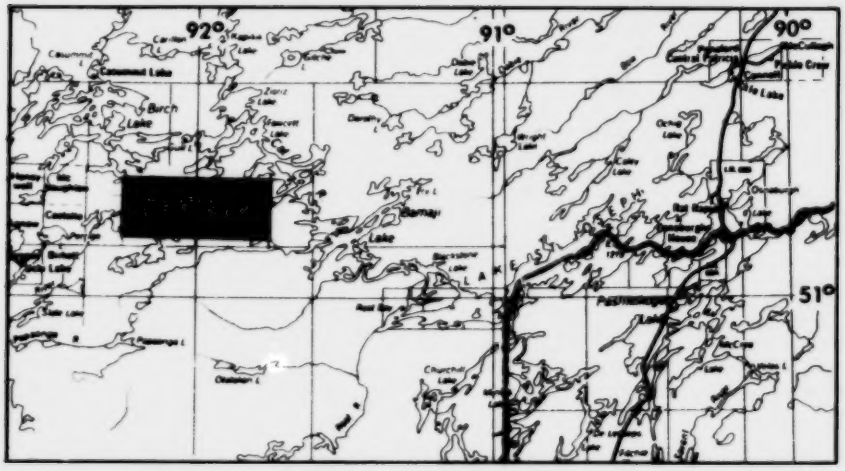

Figure 1— *Key map showing location of the Ferdinand Lake area. Scale 1:1 584 000 or 1 inch to 25 miles.*

ABSTRACT

The Ferdinand Lake area, centred 130 km east of Red Lake, comprises 507 km^2 between Latitudes 51°07′30″ to 51°15′N and Longitudes 91°45′ to 92°15′W.

The region, part of the Uchi Subprovince is underlain predominantly by granitoid rocks which flank a narrow supracrustal belt transecting the area from east to west. This belt, which consists mostly of mafic metavolcanics, forms the keel of a west plunging syncline semi-continuous with structures in the Bamaji-Fry Lake Belt to the east and the Birch Lake-Uchi Lake Belt to the west. Granitoid rocks varying from trondhjemite to granite, form several discrete intrusions all believed to be Archean in age. Pleistocene till and glaciolacustrine sand form a relatively thin veneer over the region, in which exposure is excellent.

The only notable mineral occurrences found as yet are molybdenum-bearing quartz veins and pegmatite dikes at the southwest end of Senior Lake and southeast of Fawthrop Lake.

Conversion Factors for Measurements in Ontario Geological Survey Publications

If the reader wishes to convert imperial units to SI (metric) units or SI units to imperial units the following multipliers should be used:

CONVERSION FROM SI TO IMPERIAL			CONVERSION FROM IMPERIAL TO SI		
SI Unit	*Multiplied by*	*Gives*	*Imperial Unit*	*Multiplied by*	*Gives*
			LENGTH		
1 mm	0.039 37	inches	1 inch	**25.4**	mm
1 cm	0.393 70	inches	1 inch	**2.54**	cm
1 m	3.280 84	feet	1 foot	**0.304 8**	m
1 m	0.049 709 7	chains	1 chain	20.116 8	m
1 km	0.621 371	miles (statute)	1 mile (statute)	**1.609 344**	km
			AREA		
1 cm^2	0.155 0	square inches	1 square inch	**6.451 6**	cm^2
1 m^2	10.763 9	square feet	1 square foot	**0.092 903 04**	m^2
1 km^2	0.386 10	square miles	1 square mile	2.589 988	km^2
1 ha	2.471 054	acres	1 acre	0.404 685 6	ha
			VOLUME		
1 cm^3	0.061 02	cubic inches	1 cubic inch	**16.387 064**	cm^3
1 m^3	35.314 7	cubic feet	1 cubic foot	0.028 316 85	m^3
1 m^3	1.308 0	cubic yards	1 cubic yard	0.764 555	m^3
			CAPACITY		
1 L	1.759 755	pints	1 pint	0.568 261	L
1 L	0.879 877	quarts	1 quart	1.136 522	L
1 L	0.219 969	gallons	1 gallon	**4.546 090**	L
			MASS		
1 g	0.035 273 96	ounces (avdp)	1 ounce (avdp)	28.349 523	g
1 g	0.032 150 75	ounces (troy)	1 ounce (troy)	**31.103 476 8**	g
1 kg	2.204 62	pounds (avdp)	1 pound (avdp)	**0.453 592 37**	kg
1 kg	0.001 102 3	tons (short)	1 ton (short)	**907.184 74**	kg
1 t	1.102 311	tons (short)	1 ton (short)	**0.907 184 74**	t
1 kg	0.000 984 21	tons (long)	1 ton (long)	**1016.046 908 8**	kg
1 t	0.984 206 5	tons (long)	1 ton (long)	**1.016 046 908 8**	t
			CONCENTRATION		
1 g/t	0.029 166 6	ounce (troy)/ ton (short)	1 ounce (troy)/ ton (short)	34.285 714 2	g/t
1 g/t	0.583 333 33	pennyweights/ ton (short)	1 pennyweight/ ton (short)	1.714 285 7	g/t

OTHER USEFUL CONVERSION FACTORS

1 ounce (troy)/ton (short)	20.0	pennyweights/ton (short)
1 pennyweight/ton (short)	0.05	ounce (troy)/ton (short)

NOTE—Conversion factors which are in bold type are exact. The conversion factors have been taken from or have been derived from factors given in the Metric Practice Guide for the Canadian Mining and Metallurgical Industries published by The Mining Association of Canada in cooperation with the Coal Association of Canada.

Geology of the Ferdinand Lake Area

District of Kenora, Patricia Portion

by

Henry Wallace[1]

INTRODUCTION

The geological survey upon which this report is based was undertaken to facilitate stratigraphic correlation between the Slate Falls area (Wallace 1979a,b, 1980c), and the Birch Lake area (Thurston 1978) which adjoin the Ferdinand Lake area to the east and northwest respectively. The accompanying map covers about 500 km^2, but large tracts underlain by granitoid rocks were surveyed at a reconnaissance scale only. Over half of the man-days involved in the mapping program were spent within the 20 percent of the map-area that is underlain by supracrustal rocks.

LOCATION AND ACCESS

The map-area, bounded by Latitudes 51°07'30" and 51°15'N and Longitudes 91°45' and 92°15'W is centred about 130 km east of Red Lake and 120 km due north of Sioux Lookout.

Access to the area is restricted to float- or ski-equipped aircraft which are available for charter from Red Lake, Sioux Lookout, or Pickle Lake, all roughly equidistant from Ferdinand Lake. With the exception of Fawthrop Lake, which is less than 1 m deep in many places, all of the larger lakes are suitable for float-plane landings. Transportation is difficult since few of the lakes and river systems are navigable for more than a few kilometres. Navigable by canoe with minor portages are: the Ferdinand Lake-Snelgrove Lake system; the Sesikinaga River between Sesikinaga and Marsh Lakes; and Hailstone Creek between Marsh and Hailstone Lakes. Even the use of these routes is very much dependent on water levels, which fluctuate considerably.

HISTORY OF MINERAL EXPLORATION

The map-area has received very little exploration attention to date. Gold has been sought in the region between the Red Lake and Pickle Lake camps since the 1920s but no discoveries were ever reported from the Ferdinand Lake area.

In 1969, Madsen Red Lake Gold Mines Limited did considerable work on two molybdenite showings located about 3 km north of the central part of Ferdinand Lake (Lake B). Altogether 14 trenches were cut across the molybdenite-bearing zones and 4 diamond-drill holes totalling 114 m were put down (Assessment Files Research Office, Ontario Geological Survey, Toronto (AFRO)).

In 1974, Union Miniere Exploration and Mining Corporation Limited did exploratory diamond drilling in this region following up combined airborne electromagnetic and magnetometer surveys flown in 1977. Three holes totalling 196 m were drilled to intersect conductors located between Ferdinand and Senior Lakes (location (3) on the accompanying map) but nothing of economic significance was reported (AFRO).

PREVIOUS GEOLOGICAL SURVEYS

The only previous geological mapping covering this area were large scale reconnaissance surveys by the Geological Survey of Canada (Emslie 1961; Donaldson 1960) whose maps were published at a scale of 1:253 440, and later by the Ontario Geological Survey (Sage *et al.* 1973, Sage and Breaks 1982) from which maps were prepared at scales of 1:126 720 and 1:253 440 respectively. Recent detailed mapping has taken place immediately east of the present area by Wallace (1979a,b). The area is included in ODM-GSC aeromagnetic maps 882G and 892G which are at 1:63 360 (ODM-GSC 1960a,b). The map-area is also covered by the Federal-Provincial airborne gamma-ray spectrometer survey maps 80 137 to 80 171 inclusive at a scale of 1:250 000 (OGS-GSC 1980).

FIELD MAPPING PROCEDURES

Field work for the Ferdinand Lake area was carried out in the summer of 1979. In parts of the area underlain by supracrustal rocks, mapping was done by pace-and-compass traversing at roughly right angles to the structural trends. The traverses, which were spaced roughly 0.5 km

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apart, were planned to intersect as much outcrop as possible while passing between topographic features visible on vertical air photographs. Outcrops were also examined along the shores of most lakes and river systems.

Granitic terrain was examined less intensively. Most of the geological information in these areas was obtained from lakeshore mapping. Where overland traverses were conducted, lines were commonly spaced at between 0.7 to 1.5 km intervals.

Geological data were recorded on transparent overlays attached to black and white, 1:15 840 scale, vertical air photographs, taken in 1966 and 1975, which were provided by the Air Photo Library, Ministry of Natural Resources, Toronto. Subsequently the information was transferred to base maps prepared by the Cartographic Unit, Ontario Division of Lands from Forest Resource Inventory maps of the Ontario Division of Forests, Ministry of Natural Resources, Toronto.

Uncoloured preliminary maps of the Ferdinand Lake area with accompanying marginal notes, were published at a scale of 1:15 840 in 1980 (Wallace 1980a,b).

TOPOGRAPHY AND DRAINAGE

Bedrock exposure is abundant, particularly in the eastern half of the area where there is generally 20 to 30 percent exposure. Outcrops tend to be bold and areally extensive. Maximum relief is only in the order of 30 m, but locally in well exposed parts of the area the terrain is quite rugged with steep-sided, irregular ridges and domes of outcrop separated by swampy depressions. Outcrop density decreases considerably west of Hailstone Lake where a flat blanket of sandy overburden appears to be quite thick.

There are three major drainage systems in the area. Ferdinand Lake drains southward through a chain of small lakes and creeks into Snelgrove Lake, and thence eastward into the Brokenmouth River and the Bamaji-Roadhouse-Lake St. Joseph system. Gull, Kezik and Senior Lakes empty northward and are part of the Cat River system which flows southeastward into the Bamaji-Roadhouse-Lake St. Joseph system. The Sesikinaga River and Hailstone Creek systems drain into Marsh Lake and from there into the Wenasaga River which flows southwestward into Lac Seul.

NATURAL RESOURCES

Most of this region is forested with black spruce and balsam fir. Poplar, white birch and jackpine occur in localities with better drainage and sandy soil. White cedar, larch and ash are relatively uncommon but widely distributed.

Excellent sports fishing is available on many of the lakes and rivers of the area, where pickerel and pike are abundant. Small tourist camps are located on Sesikinaga, Deaddog and Hailstone Lakes. From time to time small scale commercial fishing has been carried out on Gull Lake.

Fur-bearing animals seen by the field party include beaver, muskrat, otter, marten, and mink. Black bear, moose and woodland caribou were encountered during the survey but they do not appear to be numerous.

ACKNOWLEDGMENTS

The author was assisted in the field by T.P. Hebert, B.T. Hennessey, P. Hunt, D.K. Korpela, S.M. Malouf, J.G. Roque, and S. Young. Hennessey, Malouf, and Korpela, as senior assistants each mapped large sections of the map-area independently. Hennessey, Hunt, and Young were responsible for most of the drafting for preliminary copies of the geological maps which accompany this report.

GENERAL GEOLOGY

This region is underlain by a variety of metamorphosed Early Precambrian (Archean) supracrustal and intrusive rocks belonging to the Uchi tectono-lithologic subprovince (Ayres *et al.* 1971). Most of the supracrustal rocks occur within a narrow east-trending belt extending continuously from Deaddog Lake in the northwest to Senior Lake in the east. Pillowed and massive mafic flows, now amphibolites, make up most of this belt, but relatively small lenses of intermediate to felsic pyroclastic rocks occur in a few places in the western part of the area. A thin sequence of clastic metasediments is found along the southern side of the main belt between Ferdinand and Marsh Lakes. Between Fawthrop and Senior Lakes the mafic metavolcanics are intruded by several irregularly shaped bodies of metagabbro, but mafic intrusions are uncommon in other parts of the area.

Felsic to intermediate plutonic rocks which underlie most of the map-area and all but surround the main supracrustal belt range in composition from trondhjemite to granite (*sensu stricto*) and form portions of several discrete intrusions.

Metamorphic rank in the supracrustal rocks appear to be medium grade (Winkler 1976).

Quaternary overburden is thin in most parts of the area, with minor exceptions. Most of the region is covered by sandy till which in places exhibits good glacial fluting, but there are few prominent surficial topographical features.

A summary of rock-types occurring within the map-area is given on Table 1.

Note that in the following sections which describe the supracrustal lithologies of this area, all rocks are metamorphosed; none have retained original mineralogy and/or texture. The prefix "meta" has been omitted for brevity when referring to individual rock-types, and will only be used in the general sense (i.e.: metasediments and metavolcanics).

TABLE 1 | TABLE OF LITHOLOGIC UNITS FOR THE FERDINAND LAKE AREA.

PHANEROZOIC
CENOZOIC
QUATERNARY
PLEISTOCENE AND RECENT

Till, sand and gravel

Unconformity

PRECAMBRIAN
EARLY PRECAMBRIAN
FELSIC TO INTERMEDIATE INTRUSIVE ROCKS

Gneissic biotite trondhjemite, massive biotite and hornblende-biotite trondhjemite, foliated (commonly cataclastic and porphyroidal) biotite trondhjemite, fine grained trondhjemite, coarse grained trondhjemite to granodiorite, equigranular biotite and hornblende-biotite granodiorite, porphyritic hornblende-biotite quartz monzonite and granite, porphyritic biotite and hornblende-biotite quartz monzonite, coarse grained biotite and hornblende-biotite quartz monzonite to granodiorite, felsic feldspar porphyry, quartz-feldspar porphyry, feldspar-quartz porphyry.

Intrusive Contact

MAFIC AND ULTRAMAFIC INTRUSIVE ROCKS

Gabbro, diorite, serpentinized peridotite.

Intrusive Contact

METASEDIMENTS AND METAVOLCANICS
CHEMICAL METASEDIMENTS

Chert, interbedded quartz-magnetite ironstone and chert, calc-silicate rocks

CLASTIC METASEDIMENTS

Slate, argillite, mudstone, lithic and feldspathic wackes, pebbly sandstones, conglomerate, migmatized metasediment, biotite-quartz-feldspar schist.

FELSIC TO INTERMEDIATE METAVOLCANICS

Massive flows and related autoclastic breccias, crystal tuff, lithic-tuff, lapilli-tuff, lapillistone.

MAFIC TO INTERMEDIATE METAVOLCANICS

Massive flows and related autoclastic breccias, pillowed flows and related autoclastic breccias, pyroclastic rocks, massive amphibolite and garnetiferous amphibolite, gneissic amphibolite and garnetiferous amphibolite, migmatized mafic metavolcanics, fragmental mafic metavolcanics, coarse grained amphibolite.

Early Precambrian (Archean)

METAVOLCANICS

In this report, metavolcanics are subdivided into two major compositional categories on the basis of colour index (the amount of dark coloured minerals in a rock expressed in volume percent), which was assessed during the field work and subsequent laboratory examinations. Rocks classified as "felsic to intermediate" are characterized by colour indices less than 20 percent and include rocks of dacitic composition as well as some andesites. "Mafic to intermediate" metavolcanics have colour indices greater than 20 percent, and include all basalts and most andesitic rocks.

Mafic to Intermediate Metavolcanics

Rocks of this composition make up roughly 90 percent of the supracrustal sequence in this area. Most of these rocks are now amphibolites, varying from fine-grained along the axis of the belt to quite coarse grained near the contacts with surrounding plutonic rocks. Primary features such as pillows, tephra, amygdules, etc. are still commonly discernible despite metamorphism and tectonic deformation. Where such features were positively identified the rocks have been classified as pillowed flows, massive flows, pyroclastic rocks, etc., but where they have been obliterated the rocks have been described simply as amphibolite, garnetiferous amphibolite or coarse amphibolite (grain size greater than 0.5 cm). Most of these amphibolites are undoubtedly mafic metavolcanics but in some places, particularly south and west of Deaddog Lake, units classified as metavolcanics can equally well be interpreted as intrusive metagabbro.

PILLOWED FLOWS

Pillowed flows and selected autoclastic and hyaloclastic breccias are by far the most common volcanic rocks. In most parts of the area pillows are discernible in even coarse porphyroblastic amphibolite units. Typically the pillows are subequant and well formed, however outcrops suitable for top determinations are rare. Pillow size, selvage thickness, etc., vary considerably from flow to flow. The largest seen, about 1.5 m in the long dimension, are located northwest of Hailstone Lake, but average pillow size is approximately 80 by 30 cm. Selvages are generally thin between 0.5 and 1.0 cm.

Variolitic pillowed units were found in a few places northeast of Ferdinand Lake, and pillows containing felsic cores probably formed by the coalescence of varioles occur in the vicinity of Lake "A" (see accompanying map) and Fawthrop Lake. The presence of amygdules in pillowed flows is quite uncommon.

From the accompanying map it appears that pillowed units are far more abundant in the eastern part of the area than in the west where most of the mafic metavolcanics have been mapped as massive flows. This distribution pattern however, is probably misleading, and may be ascribable to the relative ease with which pillows can be discerned in those areas.

One rather remarkable sequence of pillowed flows occurs in northeastern Hailstone Lake. The pillows are small (less than 30 cm in the long dimension), rather angular and equant, and have very thin selvages (2 to 4 mm). The rock consists essentially of felted actinolite-tremolite and chlorite, and may be ultramafic in composition.

MASSIVE FLOWS

Massive mafic flows without obvious pillows also form a high proportion of the Ferdinand Lake supracrustal belt. The dimensions of the flows are difficult to estimate except where flow top breccias and/or interflow sedimentary units are encountered. Thicknesses of 5 to 20 m are not commonly observed between such markers. With the exception of flow breccias few primary features are discernible. Amygdules are abundant in some units, but varioles appear to be uncommon relative to their occurrence in pillowed flows.

Grain size varies from aphanitic to over 1 cm. The aphanitic rocks can be massive or highly fissile while the coarser grained rocks vary in texture from massive and isotropic, to schistose or gneissic in places. As in the pillowed units, coarsely porphyroblastic units are common. Toward the contact with the surrounding plutonic masses mafic flows are typically either gneissic or granoblastic in texture, and in these contact areas garnetiferous amphibolites are common. In a few areas along both the northern and southern edges of the supracrustal sequence, migmatitic rocks occur along the contacts. Generally these consist of *lit-par-lit* arrangements of trondhjemitic leucosome and granoblastic or gneissic amphibolite interlayered on a scale of a few centimetres to a few tens of centimetres. Rarely are the two phases in these rocks more intimately intermixed.

PYROCLASTIC ROCKS

Mafic pyroclastic rocks are a relatively rare component in the volcanic sequence. Thin mafic to intermediate lapilli-tuff and lapillistone interbeds between mafic flows were seen in several parts of the area, but the only concentration of such rocks is on the north-central shore of Marsh Lake. There, units of heterolithic lapillistone and tuff-breccia of andesitic composition occur interlayered with clastic metasediments and dacitic flow and/or fine tuff units.

In some outcrops the distinction between pyroclastic and autoclastic origin could not be made even though the fragmental and volcanic nature of the rock was established. In such cases the units were coded simply as fragmental metavolcanics without genetic connotation.

PETROGRAPHY

Two common mineral assemblages were observed in these mafic to intermediate metavolcanic rocks:

1) Hornblende + plagioclase (An_{35} to An_{55}) + Fe-Ti oxides ± quartz ± chlorite ± biotite and
2) Actinolite + plagioclase (An_{25} to An_{45}) + Fe-Ti oxides ± phlogopite ± chlorite ± epidote.

The former is the more abundant in most parts of the Ferdinand Lake area, but the actinolite-bearing rocks are

predominant in certain locations, particularly along the axis of the supracrustal belt.

Texturally, the actinolite rocks consist of felted masses of coarse feathering amphibole and commonly little else other than finely disseminated Fe-Ti oxides.

The hornblende-bearing rocks tend to consist of roughly equal proportions of hornblende and plagioclase. In many examples the hornblende forms large equant porphyroblasts (0.5 to 1.5 cm) which are commonly poikilitic. Where these are numerous, the rock takes on a blasto-ophitic texture. The large amphibole crystals are generaly surrounded in a matrix of much finer hornblende, plagioclase and quartz. Typically the plagioclase is untwinned and anhedral to subhedral, but in a few thin sections well-formed laths are common. In granoblastic rocks, hornblende and plagioclase occur as stubby crystals of similar size (typically 0.5 to 2.0 mm) forming an even mosaic texture generally with a preferred crystallographic orientation.

Felsic to Intermediate Metavolcanics

In the Ferdinand Lake area nearly all of the felsic to intermediate metavolcanics are pyroclastic. Dacitic flows were identified on the basis of colour index north of Hailstone Creek, but they appear to be unique in the area. Rarely dacitic tuff, lapilli-tuff or lapillistone beds occur between mafic flows, but most of the felsic to intermediate metavolcanics are concentrated in small lenses up to a few hundred metres thick, traceable for up to 5 km along strike within the supracrustal belt.

The largest of the felsic metavolcanic lenses, east of Hailstone Lake and north of Hailstone Creek, consists of a sequence of finely to thickly bedded lithic tuff and fine lapilli-tuff units of dacitic composition. In places these are intercalated with mafic amphibolite units which may themselves be tuffaceous.

A second sequence occurs west of Deaddog Lake where intermediate pyroclastic rocks varying from fine lithic and crystal tuff to tuff-breccia are associated with quartz-magnetite ironstone and chert units which give rise to a fairly strong aeromagnetic anomaly (ODM-GSC 1960a).

Most of the pyroclastic units are heterolithic lapillistone with dacitic, basaltic and rhyolitic clasts. The finer units such as dacitic plagioclase-phyric crystal tuffs tend to be more monolithic with few scattered andesitic lapilli.

On the north and south side of Deaddog Lake there are thicker pyroclastic sequences. The pyroclastic sequence to the north of the lake is not exposed within the map-area, but probably extends subsurface for some distance south of the thin mafic metavolcanic sequence which passes north of Deaddog Creek. Outside the map-area on the east-west shore of Deaddog Lake the unit is exposed in a few outcrops of fine monolithic rhyolitic lapillistone with small (0.5 to 1.5 cm long) very highly flattened, siliceous lapilli.

The sequence on the south side of Deaddog Lake consists of well-bedded lithic-crystal (plagioclase-bearing) tuff interbedded in places with dacitic lapilli-tuff units. Some of the tuff beds contain small garnets scattered throughout, but these beds are intercalated with non-porphyroblastic units.

The only other notable occurrence of felsic metavolcanics in the map-area is a thin sequence of rhyodacitic lapilli-tuff and tuff which occurs on the eastern side of a small lake about 1.5 km west of Senior Lake.

PETROGRAPHY

Petrographic examination of the felsic metavolcanics showed the common mineral assemblages to be:

1) Quartz + plagioclase (An_{15} to An_{25}) + biotite ± muscovite ± epidote and
2) Quartz + plagioclase (An_{26} to An_{40}) + hornblende ± biotite ± muscovite ± epidote.

In general it is very difficult to discern in thin sections fragment types within the pyroclastic rocks. Recrystallization has in nearly all cases tended to homogenize the rocks both texturally and compositionally. In a few heterolithic units variations in the ferromagnesian mineral content across fragment boundaries can be used to identify individual tephra, but in virtually monolithic rocks only the concentration of biotite and sericite along clast boundaries is indicative of their pyroclastic origin. In thin sections of crystal tuffs, plagioclase crystals are commonly somewhat rounded and in some cases appear poikiloblastic with numerous quartz inclusions. The groundmass is generally a granoblastic intergrowth of quartz, plagioclase, biotite and/or hornblende.

METASEDIMENTS

Clastic Metasediments

Nearly all of the clastic metasediments in the area occur along the southern margin of the main surpracrustal belt, where a semi-continuous sequence flanks the mafic metavolcanics to the north. The rocks along Hailstone Creek are brown-weathering quartz-feldspar-biotite schists which occur in poorly bedded sequences with relatively rare interbeds of slate and pebbly sandstones. In a few places on northern Hailstone Lake, white-weathering metawacke and pebbly sandstones appear relatively fresh, retaining much of their primary textures and structures, but these are in close proximity to quartz-feldspar-biotite schist which retain few primary features and are presumably derived from "dirtier" sandstone units. Some individual wacke units are up to 25 cm thick but most appear to be between 5 and 15 cm. These beds also tend to contain porphyroblasts of both quartz and biotite. In some units quartz and quartz-biotite stringers are pervasive.

South of the main supracrustal belt, there are several large rafts of metasediments and metavolcanics included within the granitoid rocks. Some of these are as much as 2 km long. Most of the metasediments are quartz-feldspar-biotite schists and gneisses similar to those discussed above, however, one of the largest rafts consists of metawacke beds interbedded with pebbly sandstone units and pebble and cobble conglomerates. The conglomerates are clast-supported, with the most common

clast type being highly flattened mafic amphibolite. About 10 to 20 percent of the clasts in most conglomeratic units are quartz monzonite to granite, or quartz.

Conglomeratic rocks also form part of the thick northwest-trending metasedimentary sequence around the southern end of Marsh Lake. Most of the sequence appears to consist of metawacke-mudstone units, but along the southwest shore of the lake there are units of pebble conglomerate and pebbly sandstone. These rocks are quite highly deformed and metamorphosed, and pebbles are difficult to identify and in some cases even difficult to discern. The matrix is a granoblastic or porphyroblastic biotitic schist like the nearby metawackes. The most common pebble type appears to be fine granitoid rocks or coarsely recrystallized intermediate metavolcanics. These are typically flattened to form a strong foliation, which in a few places is distinctly crenulated on a fine scale.

PETROGRAPHY

The mineral assemblages commonly found in thin sections of the clastic metasediments from this area can be summarized as: Quartz + biotite + plagioclase ± muscovite ± chlorite ± garnet ± andalusite ± sillimanite ± hornblende.

Phyllosilicate foliations are pronounced, and where bedding is discernible, the mineral foliation is quite commony at an oblique angle to it. In a few of the thin sections exposed, the bimodal grain size distribution typical of wackes is evident, and even graded bedding can be inferred from the gradual change in phyllosilicate content across individual units. In the rafts of metasediment south of the main belt, the biotitic metawackes tend to be very coarse grained with decussate textures.

Chemical Metasediments

These rocks constitute a negligible portion of the supracrustal belt. There are only two notable occurrences in the area. One is about 3 km west of Senior Lake, where a moderately strong aeromagnetic anomaly (ODM-GSC 1960a,b) extends northwestward for roughly 2.5 km. The chemical metasediments over which this anomaly occurs are exposed at the northern end of a small lake midway between Lake A (see accompanying map) and Senior Lake. They consist of interbedded finely laminated chert and quartz-magnetite ironstone with rare interbeds of amphibole-calcite rocks which probably represent original limestone intercalations.

Just west of Deaddog Lake there is a sequence of chemical metasediments made up of thinly bedded quartz-magnetite ironstone. This sequence strikes approximately north-south and appears to be responsible for the relatively weak aeromagnetic anomaly in that area (ODM-GSC 1960a). Like the occurrence west of Senior Lake these rocks are associated with a thin sequence of intermediate to felsic pyroclastic rocks which they appear to overlie. Although exposure is relatively poor in both areas, the chemical metasediments appear to be overlain by mafic metavolcanics. Both of these occurrences are far too thin to be considered as potential sources of iron ore. The average magnetite content determined petrographically is between 15 and 20 percent.

MAFIC AND ULTRAMAFIC INTRUSIVE ROCKS

Mafic and ultramafic intrusive rocks are almost entirely confined to the main supracrustal belt, and nearly all occur in a series of subconcordant tabular bodies between Senior Lake and Lake A. Most are metagabbroic to dioritic in composition, consisting of hornblende and plagioclase (An_{40} to An_{50}), but there are considerable textural differences both between and within individual bodies. These rocks are coarse- to medium-grained (average crystal size 0.2 to 0.8 cm) amphibolites in which granoblastic, porphyroblastic, gneissic and blasto-flaser textured varieties occur in close proximity. Commonly this variety of textures is the result of differential shear within a single body, but in some cases more than one magmatic phase is evident from cross-cutting relationships and very sharp contact between textural varieties. Near contacts with surrounding pillowed and massive flows, the mafic intrusions exhibit chilled margins and commmonly contain fine grained amphibolite inclusions.

The metagabbro body underlying the eastern part of Lake A is apparently intruded by a series of small serpentinized ultramafic masses. However, contacts between the mafic and ultramafic rocks were not observed by the field party, and the possibility exists that the serpentinite masses are crystal cumulate differentials of the much larger mafic intrusion. In a few places, the serpentinite was seen to include blocks of coarse porphyroblastic amphibolite believed to be derived from the mafic intrusion surrounding it, but this is uncertain.

The ultramafic rocks consist of serpentine after olivine, chlorite, tremolite and carbonate. In some cases talc and biotite are also major components. Large porphyroblasts of hornblende (0.4 to 0.8 cm) occur in some intrusions and locally asbestiform serpentine fibres up to 3 cm long were seen in gashes and veinlets in these rocks.

FELSIC TO INTERMEDIATE INTRUSIVE ROCKS

Roughly 85 percent of the Ferdinand Lake area is underlain by intrusive rocks ranging in composition from trondhjemite to pegmatoid granite (*sensu stricto*). These rocks form several large relatively homogeneous masses which probably represent discrete intrusions.

In the northeastern corner of the area, the relationships between intrusive phases are complex. Several phases (up to 12) showing cross-cutting relationships are evident in many outcrops. In general the progression from the oldest to youngest phases shows an increase in potassium content and a decrease in the degree of tectonic foliation, from strongly foliated biotite trondhjemite to massive microcline-phyric quartz monzonite and quartz. This has been described previously in more detail for the adjacent area to the east (Wallace 1980c).

To the west of the complex zone described above, around Kezik Lake, between Kezik and Fawthrop Lakes, the rocks are massive to mildly foliated hornblende-biotite quartz monzonite and granodiorite. The body is zoned, with quartz monzonite (commonly porphyritic with microcline and perthite phenocrysts) predominating in the eastern half, and equigranular granodiorite and porphyritic (plagioclase-phyric) granodiorite in the western part. All of these phases are characterized by sericitization of plagioclase and chloritization of biotite.

Between Fawthrop and Gull Lakes in the east and Deaddog Lake in the west, the terrain is underlain mostly by medium-grained weakly foliated biotite and hornblende-biotite trondhjemite. Microcline-phyric granodiorite is also a fairly common phase in this area, and is notable for its high allanite and epidote contents. Around Deaddog Lake granitoid rocks appear to form a separate crescent-shaped intrusion. Most of the body consists of biotite trondhjemite, but along the south and southeast shore of the lake the rocks become more granodioritic. These rocks are characterized by relatively high ferromagnesian mineral content (both biotite and hornblende) possibly as a result of assimilation of surrounding supracrustal material. The intrusion is probably exposed at a high level of erosion and the large area of mafic metavolcanics almost enclosed by these rocks southwest of Deaddog Lake may be interpreted as a roof pendant.

South of the main supracrustal belt the dominant phases also consist of biotite trondhjemite. Between Ferdinand Lake and the southeast corner of the map-area, the trondhjemite, which is a westward continuation of the North Bamaji Lake Intrusion (Wallace 1980c) exhibits a pronounced cataclastic foliation, the result of a series of west-northwest-trending faults splaying off the Bamaji Lake Fault Zone (Wallace 1980c) to the east. As well as the phyllosilicate minerals which form strong planar fabrics in these rocks, quartz and to a lesser extent plagioclase have a well developed preferred orientation. Quartz tends to occur in relatively large (up to 1 cm long) ellipsoidal lenses formed by recrystallization during shearing (Wallace 1980c). This gives the rock a distinctly porphyroidal appearance. Feldspar tends to retain more of its original crystal form, but in areas of intense deformation plagioclase takes on augen shapes with short pressure shadows filled with very fine grained quartzo-feldspathic material. Ribbon and mortar textures are well developed in many of the thin sections of these rocks examined. Away from the faults, toward Ferdinand Lake and to the northwest around Senior Lake, cataclastic effects diminish gradually and the trondhjemite becomes a moderately to weakly foliated equigranular rock, which exhibits granoblastic textures in a few locations.

Hornblende-biotite quartz monzonite is the most common rock-type across a long area extending from eastern Hailstone Creek to the southeastern corner of the map-area. In the northwestern part of this zone, near the supracrustal rocks, the quartz monzonite grades into biotite granodiorite. In general both rocks are equigranular, weakly foliated to massive and vary from very coarse to medium grained (greater than 2.0 to 0.3 cm). Pegmatoid rocks, which typically contain more muscovite than biotite, are predominant in many outcrops, and generally cross-cut the fine-grained phases. In places, a high proportion of the body consists of foliated trondhjemite intruded by, and with inclusions of, the more potassic rocks.

West of Snelgrove Lake is a small, rather irregular-shaped body of gneissic biotite trondhjemite. The gneissosity, which is rather vague in most parts of the intrusion, forms a pattern suggestive of a domal shape. From intrusive relationships the gneissic rocks appear to be older than the surrounding quartz monzonite and massive biotite trondhjemites found to the west. The body is homogeneous, leucocratic, and medium grained, and is characterized by numerous small metasedimentary inclusions along its margins.

Most of the southwestern corner of the map-area is underlain by biotite trondhjemite which probably forms at least three bodies distinguishable on the basis of grain size, texture, and megascopic features such as joint patterns. In the extreme southwestern corner of the area around Tarpley Lake there is a body consisting predominantly of coarse leucocratic trondhjemite to granodioirte. These rocks are generally massive, and locally include older foliated trondhjemitic phases and supracrustal rafts. Minor intrusions of white pegmatoid trondhjemite related to this body occur up to 6 km outside its contacts with the surrounding granitoid rocks.

Around Sesikinaga Lake a large body of medium-gained massive biotite trondhjemite is separated from rocks of similar composition to the north by a semi-continuous septum of mafic metavolcanics roughly 200 to 500 m wide. The body is composed of homogeneous, weakly foliated, leucocratic rock, and is typified by very strong topographic lineaments which control the shape of Sesikinaga Lake and features around it. Around the western part of the lake these topographic features form an arcuate pattern suggestive of a dome or fold structure. Similar curvilinear features, on a smaller scale, were noted around the gneissic dome west of Snelgrove Lake, but no gneissosity is evident in the Sesikinaga Lake rocks. The weak mineral foliation that is present in the rocks tends to parallel the pattern of megascopic topographic features and supports the existence of an elongated dome or antiformal fold. However, as the southern side of this intrusion was not examined for this project, the interpretation is still tentative.

North and east of the Sesikinaga Lake body is an extensive zone made up mostly of medium grained biotite trondhjemite. Parts of this zone, such as the area around the Sesikinaga River are poorly exposed, and due to inaccessibility other parts could not be examined on the ground. It is therefore possible that there is more than one intrusion within the zone, but in general it is lithologically homogeneous, consisting of weakly to moderately foliated trondhjemite, typically intruded by minor amounts of quartz monzonitic to granitic pegmatite.

Minor felsic to intermediate intrusions are very common within the supracrustal belt. These are mostly leucocratic fine grained oligoclase and/or quartz-phyric trondhjemitic rocks. The intrusions are generally sill-like,

ranging from a few centimetres to over 10 m in thickness, and typically exhibit very sharp contacts. Most of these trondhjemites have strong mineral foliations parallel to their contacts, and in some places, particularly north of Ferdinand Lake, cataclastic textures such as mortar texture have been developed.

Cenozoic

QUATERNARY

Pleistocene and Recent

Glacial, glaciolacustrine and glaciofluvial silt, sand and gravel deposits are relatively thin over most of this region. They appear to be best developed in the areas between Marsh, Sesikinaga and Hailstone Lakes and southwest of Deaddog Lake. Bouldery sandy till occupies the depressions between the abundant outcrops in the northern and eastern parts of the map-area. In the west, particularly in the areas noted above and around Deaddog and Hailstone Creek, the overburden appears to be stratified glaciolacustrine sand and silt. A few esker ridges were found in scattered localities but none of these could be traced for more than a kilometre.

Glacial striations indicate a direction of ice movement between azimuth 230° and 240°

STRUCTURAL GEOLOGY

Regional Setting

Rocks in this area form part of the Uchi Subprovince (Ayres *et al.* 1971), a major tectono-stratigraphic subdivision of the Superior Province of the Canadian Shield. The local supracrustal rocks are continuous to the east with metavolcanics and metasediments commonly referred to as the Bamaji-Fry Lake Belt (Sage and Breaks 1982), and to the west with the Birch Lake - Uchi Lake Belt (Thurston 1978). Recognized subprovince boundaries with the God's Lake and English River Subprovinces to the north and south respectively have been delineated well outside the Ferdinand Lake map-area.

Major Structural Elements

Within the local supracrustal belt the dominant structural feature is a westerly plunging syncline, the axis of which longitudinally bisects the belt. This interpretation is based on pillow top determinations mostly from the eastern part of the area; on foliation and lithologic patterns; and on air photo interpretation of topographic features around the nose of the structure near Senior Lake. About 3 km to the east of the nose of the fold, the westernmost part of the Bamaji-Fry Lake Belt forms a very similar narrow syncline with a moderately shallow plunge to the east. The most probable interpretation of this pattern of opposing axial plunges was originally proposed by Sage and Breaks (1982). The two narrow synclines were at one time the keel of a single continuous structure, but intrusion of trondhjemitic material around North Bamaji Lake bent the fold axis upward in that area. At the present level of erosion the trondhjemitic rocks occupy the gap between the two supracrustal belts.

No reliable top indicators were found in the western part of the area, so the continuation of the main fold axis there is uncertain. The situation is complicated by the domal trondhjemitic intrusion around Deaddog Lake. This body is located at a point where structural trends change markedly from east-trending (seen in the east) to north- and northwest-trending (seen southwest and west of the lake).

There are two large-scale structural domes, one around Sesikinaga Lake and the other west of Snelgrove Lake (see the "Felsic to Intermediate Plutonic Rocks" section). The smaller feature, west of Snelgrove Lake, is defined by concentric patterns of gneissosity and the distribution of xenoliths. Surrounding rocks show no evidence of displacement, and appear to be younger than the gneissic dome. The structure around Sesikinaga Lake is defined by strong curvilinear topographic features, and relatively weak mineral foliation patterns. This structure may have been formed by folding, or more probably, the intrusion may have originally been emplaced as an elongate dome.

Trondhjemitic rocks as far west as Ferdinand Lake exhibit cataclastic textures induced by the series of east-trending faults and shear zones splaying off a major northeast-trending fault known as the Bamaji Lake Fault Zone (Wallace 1980c) to the east of the area. Many of these faults form strong topographic lineaments and are shown on the accompanying map, others parallel to the set undoubtedly exist but exhibit less obvious topographic exposures. Lineaments are also commmon in other parts of the region. Only in a few instances where they coincided with stratigraphic dislocations were these features shown as faults on the accompanying map. Given the scale of mapping and the overall lack of lithologic variety throughout much of the area positive identification of faults could rarely be made.

Minor Structural Elements

Nearly all rock types exhibit planar structural and textural fabrics to some degree. For the most part these appear to have been tectonically and/or metamorphically induced. Original layering or bedding is rarely discernible except in clastic or chemical metasediments. Where these were observed, secondary foliations (i.e.: schistosity, fissility, gneissosity and foliation due to flattening of pillows, clasts, etc.) in those rocks and surrounding lithologies were generally subparallel to the primary structure.

Minor folds were rarely observed and few linear structural elements were noted during mapping.

ECONOMIC GEOLOGY

During the field survey for this report in 1979, there were no mining claims in good standing within this area, and as indicated in the "History of Mineral Exploration" section of this report there has been very little activity since the gold rush days of the 1920s.

The only notable mineral occurrences found in the project area are molybdenum-bearing zones in and around quartz zones, shear zones, and pegmatite dikes. Showings at the southwestern end of Senior Lake (location (2) on the accompanying map) have recently been described by Sutherland (1978):

The largest of these showings is located at the entrance to the large bay in the north-central region of Senior Lake. It consists of a mineralized quartz vein that occupies the intrusive contact between a fine to medium grained "felsite" to the south and a weakly foliated to unfoliated epidote-biotite trondhjemite to granodiorite to the north. The "felsite" is mineralized with fine grained, disseminated pyrite and is cut by tiny epidote stringers. Both of the intrusive phases are cut by minor dikelets of coarse grained to pegmatoid quartz monzonite. The quartz vein is about 20 cm at its widest and best mineralized location and it pinches out to the east and west. Molybdenite mineralization of locally up to 15 percent MoS_2 occurs as disseminations, banded disseminations, small stringers, and paint, primarily within the quartz vein with disseminated pyrite. Pyrite occurs in varying amounts over the entire exposed length of the quartz vein (approximately 25 m) but the presence of molybdenite is restricted to only about 5 m of the vein.

The two neighbouring outcrops to the north and south host small irregular quartz veins with minor disseminated pyrite, especially along the borders, and traces of disseminated molybdenite. The country rocks are the same weakly foliated biotite trondhjemite to granodiorite.

Two showings located north of Lake B, southeast of Fawthrop Lake, have been referred to as the Ferdinand Lake Option of Madsen Red Lake Gold Mines Limited (location (1) on the accompanying map) by Sage and Breaks (1982) who described them in detail. Both showings occur close to the contacts between trondhjemitic rocks and mafic amphibolites at the northern edge of the main supracrustal belt. In one of these showings, coarse-grained clots of molybdenite up to 1.5 cm across are sparsely disseminated with minor pyrite within foliated biotite trondhjemite and concordant quartz and quartz-potassium feldspar veins over a strike length of at least 60 m. The highest concentrations of molybdenite, over 20 percent in places, were found in a narrow (1 to 2 cm) biotite-rich zone within the trondhjemite and in a quartz vein adjacent to that zone, which both strike at approximately N75°E. In the same immediate area, just south of the metavolcanic trondhjemite contact, molybdenite was also found as disseminated patches up to 2 cm across in irregular quartz monzonitic pegmatite dikes up to 5 m wide, striking subparallel to the surrounding gneissic amphibolite. Highest assay value from this showing was 0.33 percent MoS_2 from a 0.6 m channel sample taken from trench No. 1.

The other showing, about 1 m to the west of the first, is in foliated trondhjemite about 100 m north of the metavolcanic contact. The trondhjemite contains fine-grained (less than 2 mm), sparsely disseminated molybdenite flakes with pyrite, pyrrhotite, and minor chalcopyrite. Innes (1969, p.2) reported that these are found in an area roughly 200 feet by 100 feet. However, mineralization is concentrated in and near irregular south dipping quartz and quartz-potassium feldspar veins. As in the first showing, molybdenite is particularly concentrated in narrow biotite-rich zones along the contacts between quartz veins and host trondhjemite. Innes (1969, p.2) also reported the association of molybdenite with a flat to shallow dipping quartz vein in the same area. Although favourable values were registered during the trenching (best assay 1.15 percent MoS_2 over 2.1 m) subsequent diamond drilling proved generally discouraging (diamond drilling reports 10 and 11, Assessment Files Research Office, Ontario Geological Survey, Toronto) and the option was discontinued in 1970. Best values obtained in three of four drill holes drilled normal to structural trend of the molybdenitic mineralized zones is as follows:

Hole No. 1, 0.08 percent MoS_2 over 1.38 m.
Hole No. 2, 0.96 percent MoS_2 over 0.64 m.
Hole No. 3, 0.08 percent MoS_2 over 0.58 m.
Hole No. 4, no values obtained.

Exploration information submitted for assessment credit to the Ministry of Natural Resources is summarized in Table 2.

TABLE 2 | TABLE OF DATA FILED FOR ASSESSMENT CREDIT WITH THE MINISTRY OF NATURAL RESOURCES AS OF DECEMBER 31, 1979.

Company or Individual	File Number (AFRO)	Location Number (accompanying map):	Date of Work	Type of Work
Madsen Red Lake Gold Mines Limited.	63E-22	(1)	1969	Prospecting, trenching
"	DDH-10,11 (Ferdinand L)	(1)	1969	4 diamond drill holes
Union Miniere Explorations Corporation Limited	2.1212	(3)	1972-73	Airborne magnetometer
"	DDH-12, 13, 14 (Ferdinand L)	(3)	1974	3 diamond drill holes

Recommendations for Future Mineral Exploration

Reconnaissance prospecting will possibly uncover additional molybdenum occurrences, which are numerous in this region, particularly to the east of the project area (Sutherland 1978). Several minor occurrences were found by the field party in the Gull-Christina Lakes area, and south of Ferdinand Lake. Like the showings north of Lake A the Gull Lake occurrences are located in trondhjemite quite close to the northern edge of the main supracrustal belt, suggesting some control of the mineralization. New occurrences should be checked for their gold, silver, copper, bismuth, and antimony contents.

Potential for gold discoveries is largely unknown. Few sulphide-bearing quartz veins were encountered in mapping and assayed grab samples of such material contained only traces of gold. Most such veins occur within one half kilometre of the contact between metavolcanics and the surrounding plutonic rocks, and may also be expected in the screen of large metavolcanic inclusions north of Sesikinaga Lake.

Base metal sulphide occurrences are not known in this area, but iron sulphide-rich units have been intersected in diamond drill core from between Senior and Fawthrop Lakes. Prospecting in that area, where Sage and Breaks (1982) have also reported sulphide concentrations, may find surface mineralization. The most favourable targets for base metal sulphide exploration in terms of stratigraphy are in the areas north of Hailstone Creek and north and west of Deaddog Lake, where intermediate pyroclastic rocks are concentrated and chemical metasediments are known to occur. Where observed, sulphide mineral content of these rocks appeared to be quite low, generally not exceeding 2 percent.

Investigation of the mafic and ultramafic intrusive rocks around and to the east of Lake A should be done in order to evaluate their copper and nickel potential.

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51°15'00"

92°15'00"

Bertha L.

Bumpy Cr.

Deaddog

Lake

Deaddog Creek

Hailstone Creek

MA

MA

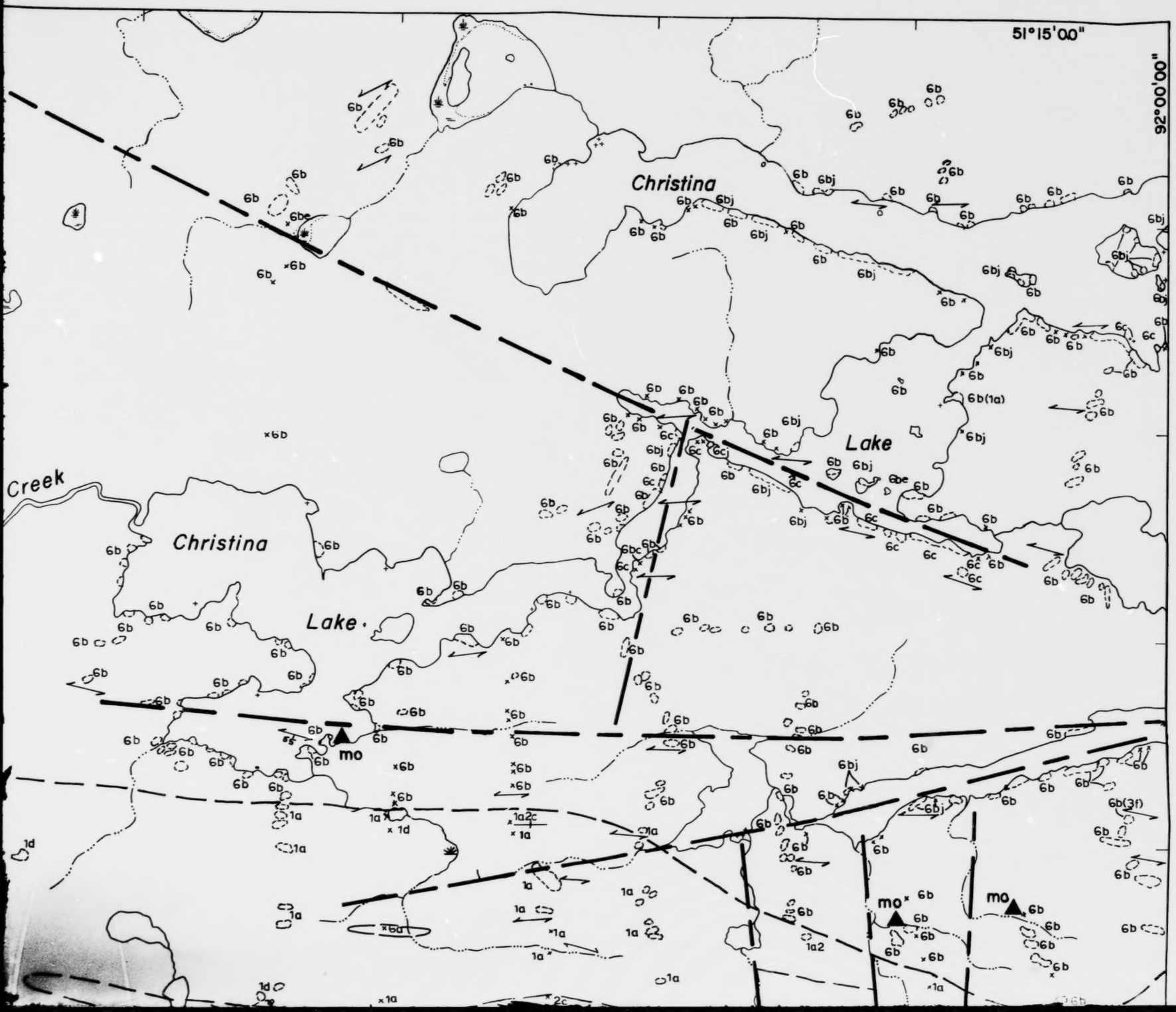
sand

Deaddog Creek

Hailstone Cr.

sand

sand



Ministry of Natural Resources
Ontario

Hon. Alan W. Pope
Minister

W.T. Foster
Deputy Minister

ONTARIO GEOLOGICAL SURVEY

MAP P.2345(REV)

GEOLOGICAL SERIES - PRELIMINARY MAP

PRECAMBRIAN GEOLOGY OF THE

FERDINAND LAKE AREA WESTERN PART

KENORA DISTRICT
PATRICIA PORTION

Scale 1:15 840

Mile ¼ 0 ¼ ½ Mile

Metres 100 0 0.2 0.4 0.6 0.8 1 Kilometre

NTS Reference: 52N/1E
ODM-GSC Aeromagnetic Map: 882G
ODM Geological Compilation Map: 2175

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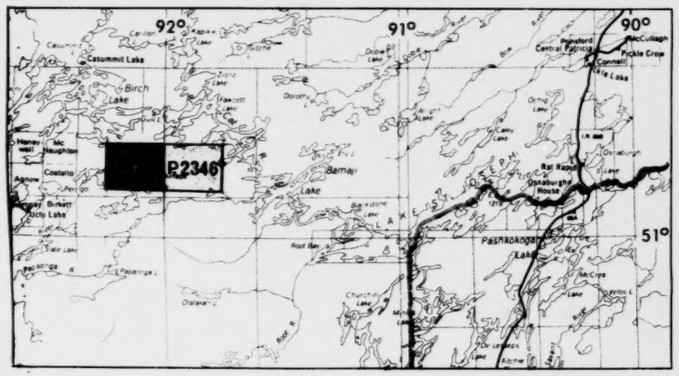


LOCATION MAP

Scale: 1: 1 584 000

LEGEND[a]

PHANEROZOIC
CENOZOIC
QUATERNARY

51°15'00"

92°00'00"

Christina Lake

Deoddog Cr

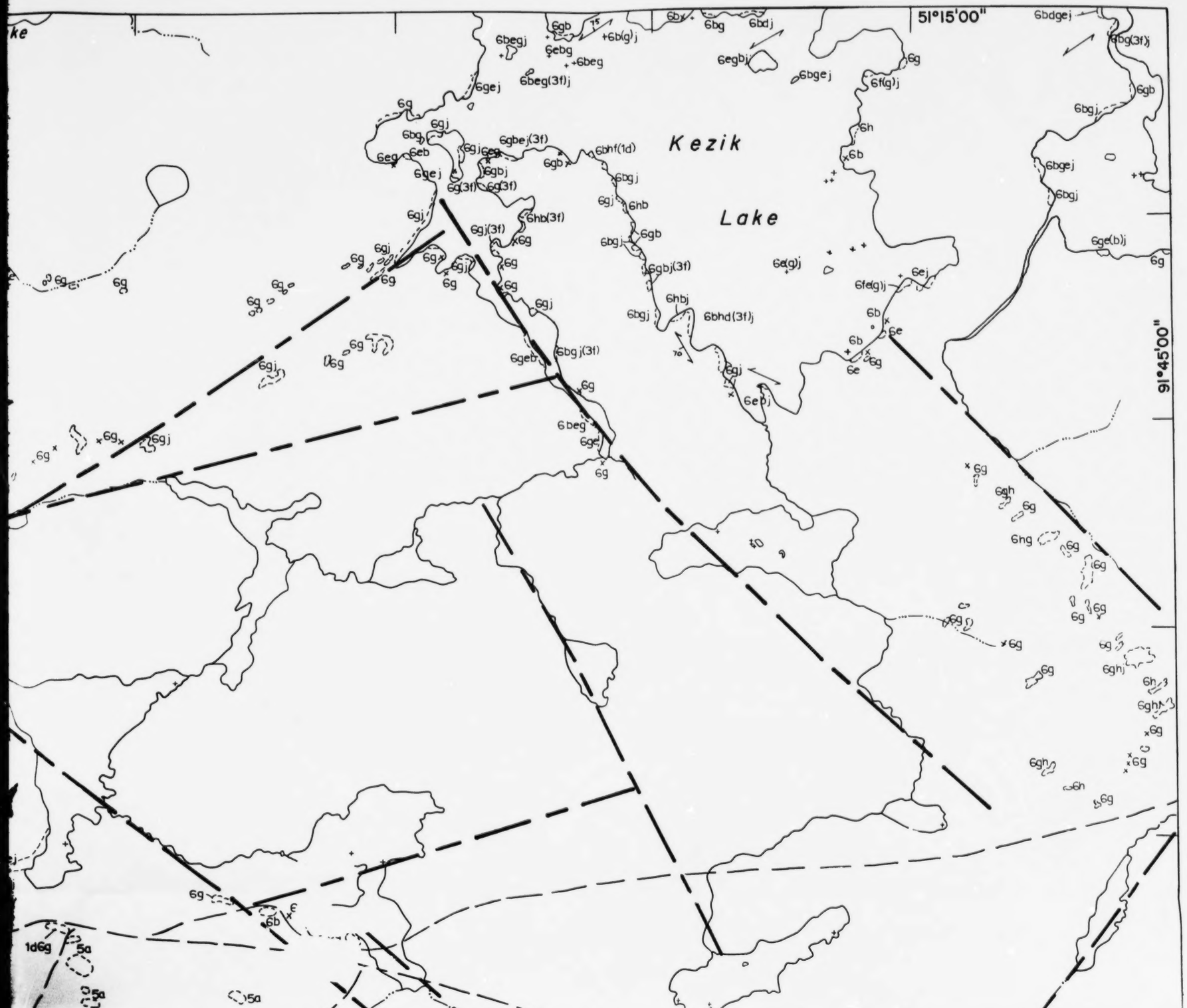
Gull Lake

Fawthrop Lake

tranches

Kezik

Lake



Ontario Ministry of Natural Resources

Hon. Alan W. Pope
Minister

W T Foster
Deputy Minister

ONTARIO GEOLOGICAL SURVEY

MAP P.2346(REV)

GEOLOGICAL SERIES - PRELIMINARY MAP

PRECAMBRIAN GEOLOGY
OF THE

FERDINAND LAKE AREA EASTERN PART

KENORA DISTRICT
PATRICIA PORTION

Scale 1:15 840

Mile ¼ 0 ¼ ½ Mile

Metres 100 0 0.2 0.4 0.6 0.8 1 Kilometre

NTS Reference: 52O/4W
ODM-GSC Aeromagnetic Map: 892G
ODM Geological Compilation Map: 2218

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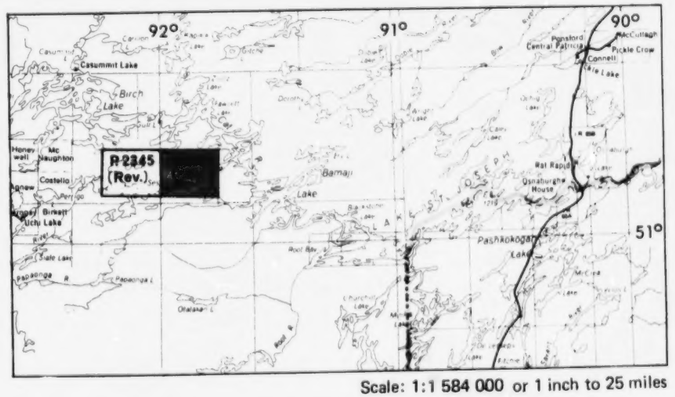

Scale: 1:1 584 000 or 1 inch to 25 miles

LEGEND[a]

PHANEROZOIC
CENOZOIC
QUATERNARY
PLEISTOCENE AND RECENT
Till, sand, and gravel (ground moraine and esker deposits)

Hailstone Creek

Marsh

Lake

Sesikinaga River

Sesikinaga R.

Margaret OL

RAPIDS

Sesikinuga River

Hailstone Lake

Hailstone Lake

Hailstone Lake

Hailstone Lake

Hailstone Creek

Adjoins P. 2346 (Rev.), Ferdinand Lake Area, (Eastern Part)

LOCATION MAP

Scale: 1: 1 584 000

LEGEND[a]

PHANEROZOIC
CENOZOIC
QUATERNARY
PLEISTOCENE AND RECENT

Till, sand, and gravel (ground moraine and esker deposits)

UNCONFORMITY

PRECAMBRIAN[b]
EARLY PRECAMBRIAN (ARCHEAN)
FELSIC TO INTERMEDIATE INTRUSIVE ROCKS

6 Unsubdivided
6a Gneissic leucocratic biotite trondhjemite
6b Medium-grained, massive to moderately foliated biotite and hornblende-biotite trondhjemite
6c Foliated biotite trondhjemite, commonly cataclastic and porphyroidal
6d *Fine-grained, massive to foliated biotite trondhjemite*
6e Medium-grained, equigranular, massive to foliated biotite and hornblende-biotite granodiorite
6f Massive porphyritic hornblende-biotite granodiorite
6g Fine- to medium-grained, massive to foliated biotite and hornblende-biotite quartz monzonite, granite
6h Massive, porphyritic biotite and hornblende-biotite, quartz monzonite
6j Massive coarse- to medium-grained biotite and hornblende-biotite quartz monzonite to granodiorite
6k Massive coarse- to medium-grained biotite trondhjemite to granodiorite
6n Felsic feldspar porphyry, quartz-feldspar porphyry
6q Felsic feldspar-quartz porphyry

INTRUSIVE CONTACT

METAMORPHOSED MAFIC AND ULTRAMAFIC INTRUSIVE ROCKS

5 Unsubdivided
5a Massive to gneissic gabbro, diorite
5b Serpentinized peridotite

INTRUSIVE CONTACT

METASEDIMENTS AND METAVOLCANICS[c]
METASEDIMENTS
Chemical Metasediments

4 Unsubdivided
4a Chert, massive to finely laminated
4b Interbedded quartz-magnetite ironstone and chert
4c Calc-silicate rock (actinolite-dolomite-calcite-quartz), massive to vaguely layered

Clastic Metasediments

3 Unsubdivided
3a Slate, argillite, mudstone
3b Lithic wacke, feldspathic wacke
3c Pebbly sandstone
3d Conglomerate
3e Migmatized metasediment (40 to 80 percent neosome)
3f Biotite-quartz-feldspar schist

West Half

Hailstone Creek

Fawthrop

Sausage L.

Finger L

Ferdinand Lake

Mo.py

2 DH

trenches

Mo,cp,py,po

Mo,py

"B"

"A"

MA

G4

MA

DH

trenches

Moon L°

DH (3f4ac)
gf,S

DH(1d2)
gf,S

LEGEND[a]

PHANEROZOIC
CENOZOIC
QUATERNARY
PLEISTOCENE AND RECENT

Till, sand, and gravel (ground moraine and esker deposits)

UNCONFORMITY

PRECAMBRIAN[b]
EARLY PRECAMBRIAN (ARCHEAN)
FELSIC TO INTERMEDIATE INTRUSIVE ROCKS

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6d Fine-grained, massive to foliated biotite trondhjemite
6e Medium-grained, equigranular, massive to foliated biotite and hornblende-biotite granodiorite
6f Massive porphyritic hornblende-biotite granodiorite
6g Fine- to medium-grained, massive to foliated biotite and hornblende-biotite quartz monzonite, granite
6h Massive, porphyritic biotite and hornblende-biotite, quartz monzonite
6j Massive coarse- to medium-grained biotite and hornblende-biotite quartz monzonite to granodiorite
6k Massive coarse- to medium-grained biotite trondhjemite to granodiorite
6n Felsic feldspar porphyry, quartz-feldspar porphyry
6q Felsic feldspar-quartz porphyry

INTRUSIVE CONTACT

METAMORPHOSED MAFIC AND ULTRAMAFIC INTRUSIVE ROCKS

5 — 5 Unsubdivided
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INTRUSIVE CONTACT

METASEDIMENTS AND METAVOLCANICS[c]
METASEDIMENTS
Chemical Metasediments

4 — 4 Unsubdivided
4a Chert, massive to finely laminated
4b Interbedded quartz-magnetite ironstone and chert
4c Calc-silicate rock (actinolite-dolomite-calcite-quartz), massive to vaguely layered

Clastic Metasediments

3 — 3 Unsubdivided
3a Slate, argillite, mudstone
3b Lithic wacke, feldspathic wacke
3c Pebbly sandstone
3d Conglomerate
3e Migmatized metasediment (40 to 80 percent neosome)
3f Biotite-quartz-feldspar schist

Lake

Tarpley

Sesikinaga

Lake

92°15'00"

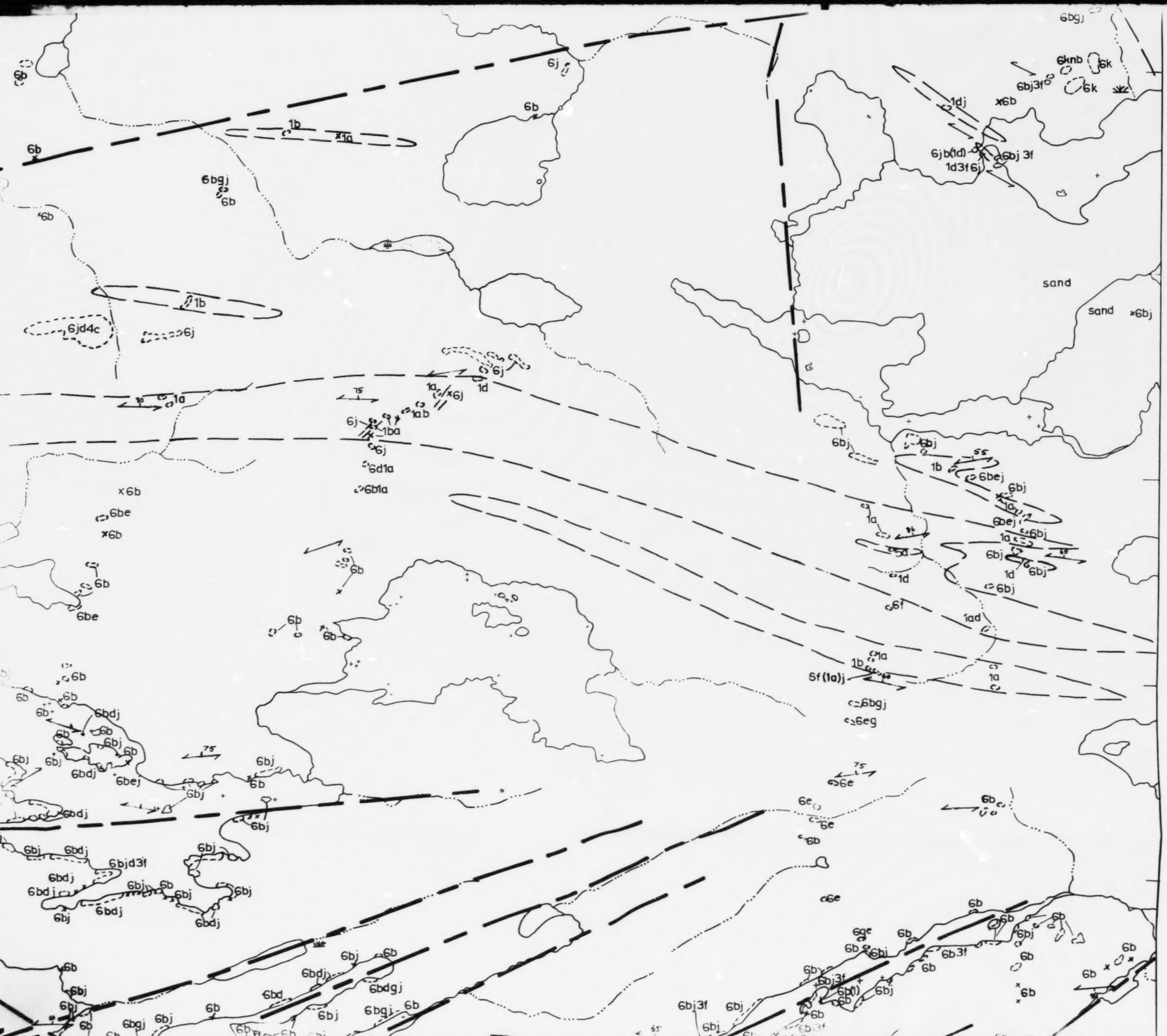
sand

sand

Sesikinaga

Lake

Sesikinaga


6b
6j
1b
x1a
6bgj
x6b
1b
6jd4c
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1d
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1ba
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6b1a
x6b
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x6b
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6b(1d3f)e
6g(1d)j
6b(3f1d)j
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6e(3f)gbj
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6g
6jbg
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6bgj
6gjx
6g
6j(1d)gb
6gj(b)
6b3e
6g(3f)b
6g
6gj
6gj
6j(1d3f)
6j(3f)
6b(c)
6bje
6b(3f)j
6g
6gj
6gj
6gj
6bj
6bj
6gjb
6cj
6b(c1d)j
6cj
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mo
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6gjc
6jg
6gjc(1a)
3d6j
6g3f
6g
6jc(1e)
6cjg3d1
3bd
6j(1d)
6j3e
6j(3)
3f6je
6jge
6jge(i)
6jc
6ej
6jc(1e)
6gj
6gj
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6gj
6gj
6jg
6gj1d
6j
6gj
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6cj
6j
1a
6bj1a
6bj
6cj1a
6b
6b
6b
6be
6g
6g
6g

6cj 6jc 6cj 6c 6cj 6jc 6cj 6cj 6jc 6cj 6cj 6jc 6cj

Adjacent to P. 2247, Slate Falls Area, (Western Part)

Felsic to Intermediate Metavolcanics

2

- 2 Unsubdivided
- 2a Massive flows, autoclastic breccia[d]
- 2b Crystal tuff
- 2c Lithic tuff
- 2e Lapilli-tuff
- 2f Lapillistone

Mafic to Intermediate Metavolcanics

1

- 1 Unsubdivided
- 1a Massive, aphanitic to fine-grained flows, autoclastic breccias
- 1b Pillowed flows, autoclastic breccias
- 1c Pyroclastic rocks
- 1d Massive medium-grained amphibolite, garnetiferous amphibolite
- 1e Gneissic medium-grained amphibolite, garnetiferous amphibolite
- 1f Migmatized mafic metavolcanics (40 to 80 per cent neosome)
- 1g Fragmental mafic metavolcanics (unsubdivided)
- 1h Coarse-grained amphibolite[d]

NOTES

a This is basically a field legend, subject to change as a result of further field work and subsequent laboratory investigations.

b Subdivisions of major rock units do not indicate age relationships. This is a lithologic map; rocks similarly classified may be of very different age and stratigraphic position.

c Age relationships between rocks coded as 1, 2, 3, and 4 are variable and in many cases uncertain.

d May in part be intrusive.

G The letter 'G' preceding a rock unit name (e.g. G4) indicates that the interpretation is based on geophysical data only.

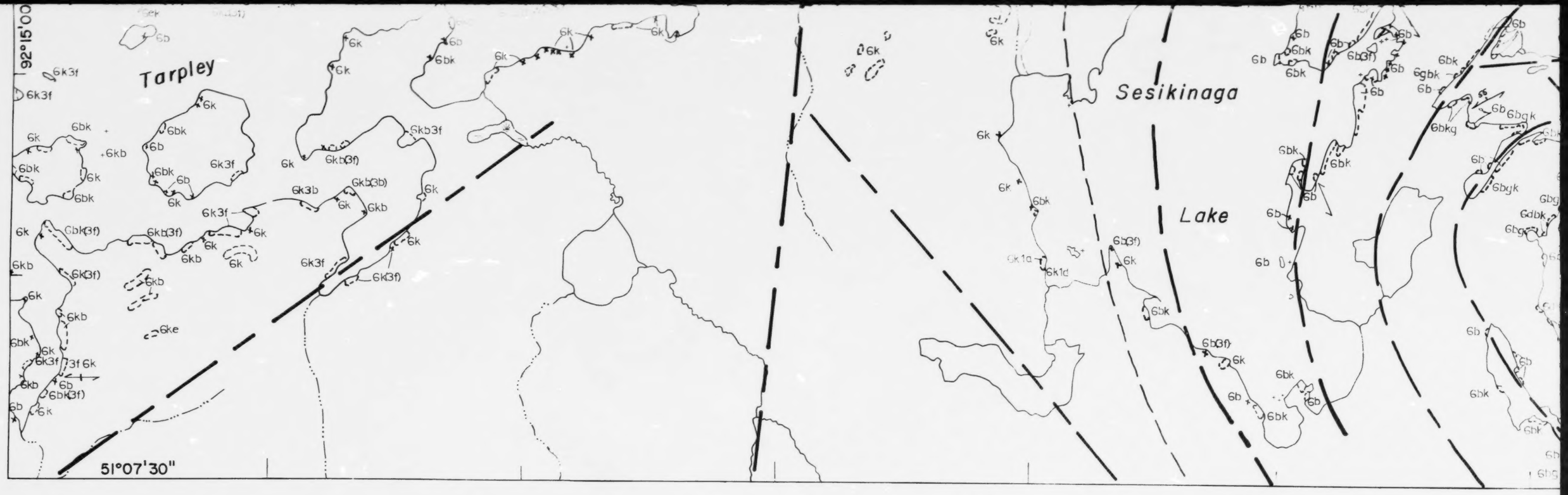
ABBREVIATIONS

cp	Chalcopyrite
gf	Graphite
mo	Molybdenite
Mo	Molybdenum
po	Pyrrhotite
py	Pyrite
s	Sulphide mineralization

SYMBOLS

- Glacial striae; direction known, direction unknown
- Esker
- Small bedrock outcrop
- Area of bedrock outcrop
- Bedding, top unknown; inclined, vertical
- Lava flow, top from pillow shape and packing
- Gneissosity; horizontal, inclined, vertical
- Lineation with plunge
- Geological boundary, position interpreted
- Lineament
- Anticline, syncline, with plunge
- Diamond drillhole; vertical, inclined
- MA — Magnetic anomaly
- Foliation; horizontal, inclined, vertical, dip unknown
- Mineral occurrence

PROPERTIES AND OCCURRENCES



MARGINAL NOTES

LOCATION AND ACCESS

The centre of the map-area is about 130 km east of Red Lake and 120 km due north of Sioux Lookout. Access to the area is restricted to float- or ski-equipped aircraft which are available for charter from Red Lake, Sioux Lookout, or Pickle Lake, roughly equidistant from Ferdinand Lake. With the exception of Fawthrop Lake, which is less than one metre deep in many places, all of the larger lakes in the area are suitable for float-plane landings. Transportation within the area is difficult, because few of the lakes and river systems are navigable for more than a few kilometres. Navigable by canoe under good conditions with minor portages are: the Ferdinand Lake Snelgrove Lake system, the Sesikinaga River between Sesikinaga and Marsh Lakes and Hailstone Creek between Marsh and Hailstone Lakes.

HISTORY OF MINERAL EXPLORATION

The map-area has received very little exploration to date. Gold has been sought in the region between the Red Lake and Pickle Lake camps since the 1920s, but no discoveries were ever reported in the Ferdinand Lake area.

In 1969, Madsen Red Lake Gold Mines Limited (property 1) did considerable work on two molybdenite showings located about 3 km north of Ferdinand Lake (Lake "B"). Altogether, 14 trenches were cut across the molybdenite-bearing zones and 4 diamond drillholes totalling 114 m in length were put down (Assessment Files Research Office, Ontario Geological Survey, Toronto (AFRO)).

In 1974 Union Miniere Explorations Corporation Limited (property 3) did exploratory diamond drilling in this region, following up combined airborne electromagnetic and magnetometer surveys flown in 1972. Three holes totally 196 m in length were drilled to intersect conductors between Ferdinand and Senior Lakes, but nothing of economic significance was reported (AFRO).

GENERAL GEOLOGY

The only previous geological mapping covering this area was large-scale reconnaissance surveys by the Geological Survey of Canada (Emslie 1961, Donaldson 1960), whose maps were published at a scale of 1:253 440, and later by the Ontario Division of Mines (Sage *et al.* 1973, Sage and Breaks 1982), from which maps were prepared at scales of 1:126 720 and 1:253 440 respectively. Recent detailed mapping has taken place immediately east of the present area (Wallace 1979a, 1979b).

The region is underlain by a variety of metamorphosed Early Precambrian (Archean) supracrustal and intrusive rocks belonging to the Uchi tectono-lithologic subprovince (Ayres *et al* 1971). Most of the local supracrustal rocks, which constitute only about 20%of the map-area, occur within the main east-trending belt extending continuously from Deaddog Lake in the northwest to Senior Lake in the east. South of Senior Lake, this predominantly mafic metavolcanic belt is truncated and separated by a gap of some 6 km, occupied by part of a major trondhjemitic intrusion from a narrow extension of the Bamaji - Fry Lake belt, which is quite similar to the former in all respects (Wallace 1979a, 1979b). Within the local supracrustal belt by far the most common rocks are fine-grained fissile amphibolite units in which pillows are commonly discernible but rarely usable as reliable top indicators. Near contacts with the plutonic masses to the north and south of the supracrustal belt, the amphibolite unit rocks are commonly coarse-grained, migmatized to varying degrees, and cut by innumerable minor sill-like injections of porphyritic and aphyric trondhjemite to granodiorite.

Felsic to intermediate metavolcanics occur to an appreciable extent in only a few places, notably north of Hailstone Creek and north and west of Deaddog Lake. These units appeared to be mostly monolithic dacitic lithic tuffs and lapilli-tuffs. Units containing tephra coarser-grained than lapilli are rare.

Clastic metasediments are found mostly on the southern side of the supracrustal belt, but minor interflow units of wacke and mudstone occur, scattered throughout the mafic flows. The metasediments are thickest in the areas west of Marsh Lake, where highly deformed polymictic paraconglomerates and coarse-grained wacke units form a high proportion of the stratigraphic sequence, and south of Hailstone Creek where the metasediments are biotite schists derived from muddy sandstones.

Chemical metasediments which give rise to appreciable positive magnetic anomalies occur just west of Deaddog Lake and between Senior and Fawthrop Lakes. The chemical metasedimentary sequence to the west of Deaddog consists of interlaminated magnetite-quartz ironstone and pure chert in close association with a thin sequence of dacitic rocks. The sequence to the west of Senior Lake is also predominantly magnetite-quartz ironstone and chert, but units of graphitic schist, pyrrohtite, and calc-silicate (consisting of amphibole and carbonate) also occur interlayered with them. These chemical metasediments are associated with fine clastic metasediments and intermediate tuff units.

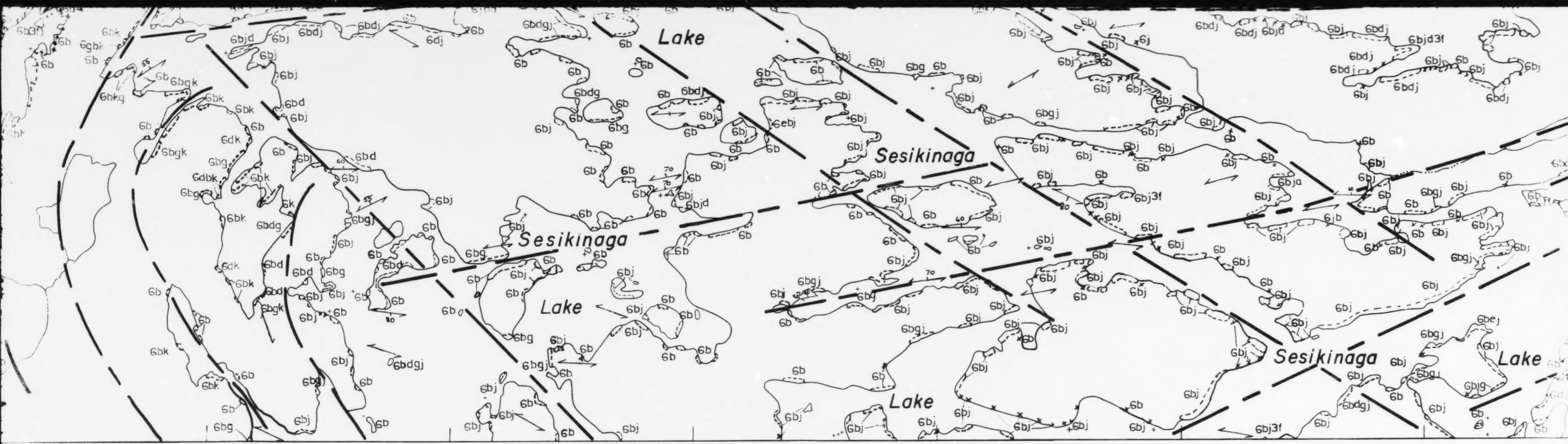
The mafic intrusive bodies between Senior Lake and Lake "A" consist mostly of massive medium- to coarse-grained gabbro and diorite. In a few places around Lake "A" minor sills and dikes of serpentinized peridotite cut the gabbro; in other cases, the ultramafic rocks appear to form part of the larger mafic bodies. Several outcrops of coarse-grained amphibolite occur in a small zone south of Deaddog Lake and in a few places around Marsh Lake. These are classified as mafic metavolcanics, but they can equally well be interpreted as gabbros.

The plutonic rocks in this area range from trondhjemite to granite in composition, and form several discrete zones which probably constitute separate intrusive events. Biotite trondhjemite intruded only by late quartz-monzonitic pegmatite dikes is volumetrically predominant in the large area around Gull, Christina, Fawthrop, and Deaddog Lakes; between Ferdinand and Snelgrove Lakes; and around Sesikinaga Lake. Some hornblende-rich variations of the trondhjemite were also found around Deaddog Lake. In the northeastern corner of the area, around Kezik Lake, the intrusive history is complex; younger quartz monzonite and granodioritic phases are most abundant. An extensive zone of pegmatitic biotite-quartz monzonite exists between the southeastern corner of the project area and Hailstone Lake. The discrete pluton around Tarpley Lake consists mostly of massive pegmatoid trondhjemite to granodiorite. Just west of Snelgrove Lake, there is a small body of gneissic biotite trondhjemite with concentric lineaments and foliation patterns.

Metamorphic rank in the supracrustal rocks appears to be medium grade (Winkler 1976), but no diagnostic index minerals were identified in the field.

With the exception of a few areas, such as between Sesikinaga and Ferdinand Lakes, the outcrop density is high, probably averaging over 15%.

Quaternary overburden appears to be thin in all parts of the area, with minor exceptions. Most of the region is covered by sandy till, which in places exhibits good glacial fluting, but there are few prominent surficial topographic features.



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STRUCTURAL GEOLOGY

Minor Features

Nearly all of the rocks in the area exhibit planar structural and textural fabrics to some degree. For the most part these appear to be tectonically and or metamorphically induced. Original bedding or layering was rarely distinguishable except in clastic and chemical metasedimentary units. Where this was observed, secondary foliations (*i.e.* schistosity, fissility, gneissosity, foliation due to flattening of pillows, clasts, etc.) in those rocks and surrounding lithologies were generally subparallel to primary planar structures.

Minor folds were rarely observed in the area, and few linear structural elements were noted during mapping.

Major Features

On the basis of bedding and foliation patterns, the local supracrustal rocks appear to be in a synformal configuration, with a relatively shallow westerly plunge. Facing determinations were made in only a few places, but these suggest that the fold is in fact a syncline.

As far west as Ferdinand Lake, trondhjemitic rocks have moderately well-developed cataclastic textures. These textures were induced by the effects of the east-trending faults seen in the southeastern part of the area. These effects are better developed just to the east of the project area, around North Bamaji Lake (Wallace 1979a, 1979b).

Many of the numerous lineaments shown on this map are probably faults, but in only a few instances can stratigraphic dislocations be demonstrated, given the scale of mapping and overall lack of lithologic variation.

ECONOMIC GEOLOGY

The only notable mineral occurrences found in the project area are molybdenum-bearing zones in and around quartz zones, shear zones, and pegmatite dikes. Showings at the southwestern end of Senior Lake (property 2) have recently been described by Sutherland (1978):

> The largest of these showings is located at the entrance to the large bay in the north-central region of Senior Lake. It consists of a mineralized quartz vein that occupies the intrusive contact between a fine to medium grained 'felsite' to the south and a weakly foliated to unfoliated epidote-biotite trondhjemite to granodiorite to the north. The 'felsite' is mineralized with fine grained, disseminated pyrite and is cut by tiny epidote stringers. Both of the intrusive phases are cut by minor dikelets of coarse grained to pegmatoid quartz monzonite. The quartz vein is about 20 cm at its widest and best mineralized location and it pinches out to the east and west. Molybdenite mineralization of locally up to 15 percent MoS_2 occurs as disseminations, banded disseminations, small stringers, and paint, primarily within the quartz vein with disseminated pyrite. Pyrite occurs in varying amounts over the entire exposed length of the quartz vein (approximately 25 m) but the presence of molybdenite is restricted to only about 5 m of the vein.
>
> The two neighbouring outcrops to the north and south host small irregular quartz veins with minor disseminated pyrite, especially along the borders, and traces of disseminated molybdenite. The country rocks are the same weekly foliated biotite trondhjemite to granodiorite.

Two showings located north of Lake "B", southeast of Fawthrop Lake, have been referred to as the Ferdinand Lake Option of Madsen Red Lake Gold Mines Limited (property 1) by Sage and Breaks (1982). Both showings occur close to the contacts between trondhjemitic rocks and mafic amphibolites at the northern edge of the main supracrustal belt. In one of these showings coarse-grained clots of molybdenite, up to 1.5 cm across, are sparsely disseminated with minor pyrite within foliated biotite trondhjemite and concordant quartz and quartz-potassium feldspar veins over a strike length of at least 60 m. The highest concentrations of molybdenite, over 20% in places, were found in a narrow (1 to 2 cm) biotite-rich zone within the trondhjemite and in a quartz vein adjacent to that zone, which both strike at approximately N75°E. In the same immediate area, just south of the metavolcanic-trondhjemite contact, molybdenite was also found as disseminated patches up to 2 cm across in irregular quartz monzonitic pegmatite dikes up to 5 m wide, striking subparallel to the surrounding gneissic amphibolite. The highest assay value from this showing was 0.33% MoS_2 from a 0.6 m channel sample taken from trench No. 1.

The other showing, about 1 km to the west of the first, is in foliated trondhjemite about 100 m north of the metavolcanic contact. The trondhjemite contains fine-grained (< 2 mm), sparsely disseminated molybdenite flakes with pyrite, pyrrhotite, and minor chalcopyrite. Innes (1969, p.2) reported that these are found in an area roughly 200 feet by 100 feet. However, these are found over a wide area, but the mineralization is concentrated in and near irregular south-dipping quartz and quartz-potassium feldspar veins. As in the first showing, molybdenite is particularly concentrated in narrow biotite-rich zones along the contacts between quartz veins and host trondhjemite. Innes (1969, p.2) also reported the association of molybdenite with a flat- to shallow-dipping quartz vein in the same area. Although favourable values were registered during the trenching (best assay 1.15% MoS_2 over 2.1 m) subsequent diamond drilling proved generally discouraging (Diamond Drilling Reports 10 and 11, Assessment Files Research Office, Ontario Geological Survey, Toronto) and the option was discontinued in 1970. The best values obtained in 3 of 4 diamond-drill holes drilled normal to the structural trend of the molybdenite mineralized zones are as follows:

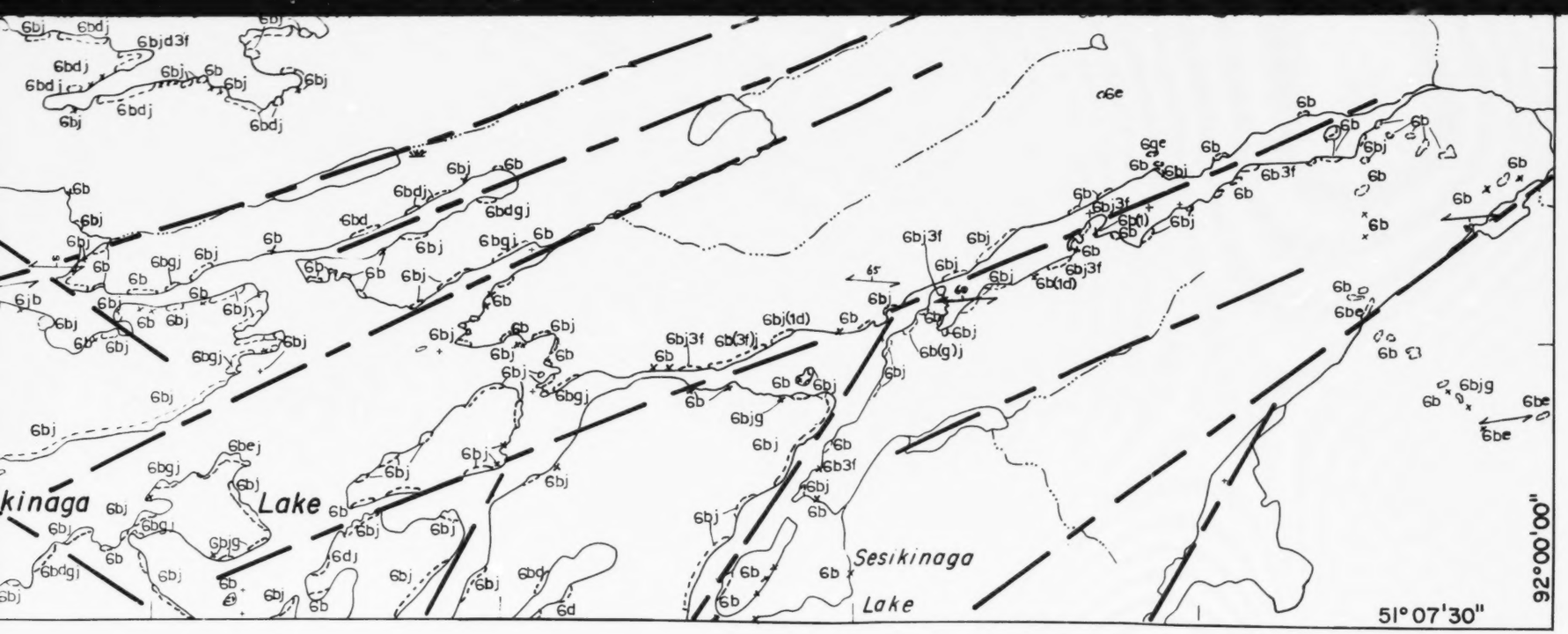
Hole No. 1 - 0.08% MoS_2 over 1.38 m
Hole No. 2 - 0.96% MoS_2 over 0.64 m
Hole No. 3 - 0.08% MoS_2 over 0.58 m
Hole No. 4 - no values obtained

RECOMMENDATIONS FOR FUTURE EXPLORATION

Reconnaissance-prospecting will possibly uncover a num occurrences, which are numerous in this regio east of the project area (Sutherland 1978). Several were found by the field party in the Gull Christina Lak of Ferdinand Lake. Like the showings north of Lake occurrences are located in trondhjemite quite close t of the main supracrustal belt, suggesting some contro tion. New occurrences should be checked for their g bismuth, and antimony contents.

Potential for gold discoveries is largely unknown. Fe quartz veins were encountered in mapping, and asse of such material contained only traces of gold. Most within 0.5 km of the contact between metavolcanics a plutonic rocks, and may also be expected in the scree canic inclusions north of Sesikinaga Lake.

Base-metal sulphide mineralization is not known in thi phide-rich units have been intersected in diamond tween Senior and Fawthrop Lakes. Prospecting in tha and Breaks (1982) have also reported sulphide mine surface occurrences. The most favourable targets



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Hole No. 3 - 0.08% MoS_2 over 0.58 m
Hole No. 4 - no values obtained

RECOMMENDATIONS FOR FUTURE MINERAL EXPLORATION

Reconnaissance-prospecting will possibly uncover additional molybdenum occurrences, which are numerous in this region, particularly to the east of the project area (Sutherland 1978). Several minor occurrences were found by the field party in the Gull Christina Lakes area, and south of Ferdinand Lake. Like the showings north of Lake "A", the Gull Lake occurrences are located in trondhjemite quite close to the northern edge of the main supracrustal belt, suggesting some control of the mineralization. New occurrences should be checked for their gold, silver, copper, bismuth, and antimony contents.

Potential for gold discoveries is largely unknown. Few sulphide-bearing quartz veins were encountered in mapping, and assayed grab samples of such material contained only traces of gold. Most such veins occur within 0.5 km of the contact between metavolcanics and the surrounding plutonic rocks, and may also be expected in the screen of large metavolcanic inclusions north of Sesikinaga Lake.

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Investigation of the mafic and ultramafic intrusive rocks around and to the east of Lake "A" should be done in order to evaluate their copper and nickel potential.

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Area of bedrock outcrop

Bedding, top unknown; inclined, vertical

Lava flow, top from pillow shape and packing

Gneissosity; horizontal, inclined, vertical

with plunge

Diamond drillhole; vertical, inclined

MA — Magnetic anomaly

Foliation; horizontal, inclined, vertical, dip unknown

Mineral occurrence

PROPERTIES AND OCCURRENCES

1. Madsen Red Lake Gold Mines Limited (Ferdinand Lake Occurrence)
2. Senior Lake Molybdenite Occurrence
3. Union Miniere Explorations and Mining Corporation Limited [1974]*

*Date in square bracket refers to last date of exploration activity.

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Air photographs from the Air Photo Library, Ontario Ministry of Natural Resources. ODM-GSC Aeromagnetic Series Maps 882G, Jeanette Lake, Scale 1:63 360, 1960.

Bamaji Lake - St. Joseph Lake Area, Ontario Division of Mines, Preliminary Map P.808, 1973, by R.P. Sage, F.W. Breaks, and W.R. Troup. Scale 1:126 720 or 1 inch to 2 miles.

Red Lake - Birch Lake Sheet, Kenora District, Ontario Department of Mines, Map 2175, Geological Compilation Series, 1970, by Ferguson, S.A., Brown, D.D., Davies, J.C., and Prystay, A.P. Scale 1:253 440 or 1 inch to 4 miles.

Assessment Files Research Office, Ontario Geological Survey, Toronto.

Magnetic Declination 2°59'E, 1979.

Metric Conversion Factor: 1 foot = 0.3048 m.

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Issued 1983

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MARGINAL NOTES

LOCATION AND ACCESS

The centre of the map-area is about 130 km east of Red Lake and 120 km due north of Sioux Lookout. Access to the area is restricted to float- or ski-equipped aircraft which are available for charter from Red Lake, Sioux Lookout, or Pickle Lake, roughly equidistant from Ferdinand Lake. With the exception of Fawthrop Lake, which is less than one metre deep in many places, all of the larger lakes in the area are suitable for float-plane landings. Transportation within the area is difficult, because few of the lakes and river systems are navigable for more than a few kilometres. Navigable by canoe under good conditions with minor portages are: the Ferdinand Lake Snelgrove Lake system, the Sesikinaga River between Sesikinaga and Marsh Lakes and Hailstone Creek between Marsh and Hailstone Lakes.

HISTORY OF MINERAL EXPLORATION

The map-area has received very little exploration to date. Gold has been sought in the region between the Red Lake and Pickle Lake camps since the 1920s, but no discoveries were ever reported in the Ferdinand Lake area.

In 1969, Madsen Red Lake Gold Mines Limited (property 1) did considerable work on two molybdenite showings located about 3 km north of Ferdinand Lake (Lake "B"). Altogether, 14 trenches were cut across the molybdenite-bearing zones and 4 diamond drillholes totalling 114 m in length were put down (Assessment Files Research Office, Ontario Geological Survey, Toronto (AFRO)).

In 1974 Union Miniere Explorations Corporation Limited (property 3) did exploratory diamond drilling in this region, following up combined airborne electromagnetic and magnetometer surveys flown in 1972. Three holes totally 196 m in length were drilled to intersect conductors between Ferdinand and Senior Lakes, but nothing of economic significance was reported (AFRO).

GENERAL GEOLOGY

The only previous geological mapping covering this area was large-scale reconnaissance surveys by the Geological Survey of Canada (Emslie 1961, Donaldson 1960) whose maps were published at a scale of 1:253 440, and later by the Ontario Division of Mines (Sage *et al* 1973, Sage and Breaks 1982), from which maps were prepared at scales of 1:126 720 and 1:253 440 respectively. Recent detailed mapping has taken place immediately east of the present area (Wallace 1979a, 1979b).

The region is underlain by a variety of metamorphosed Early Precambrian (Archean) supracrustal and intrusive rocks belonging to the Uchi tectono-lithologic subprovince (Ayres *et al* 1971). Most of the local supracrustal rocks, which constitute only about 20% of the map-area, occur within the main east-trending belt extending continuously from Deaddog Lake in the northwest to Senior Lake in the east. South of Senior Lake, this predominantly mafic metavolcanic belt is truncated and separated by a gap of some 6 km, occupied by part of a major trondhjemitic intrusion from a narrow extension of the Bamaji - Fry Lake belt, which is quite similar to the former in all respects (Wallace 1979a, 1979b). Within the local supracrustal belt by far the most common rocks are fine-grained fissile amphibolite units in which pillows are commonly discernible but rarely usable as reliable top indicators. Near contacts with the plutonic masses to the north and south of the supracrustal belt, the amphibolite unit rocks are commonly coarse-grained, migmatized to varying degrees, and cut by innumerable minor sill-like injections of porphyritic and aphyric trondhjemite to granodiorite.

Felsic to intermediate metavolcanics occur to an appreciable extent in only a few places, notably north of Hailstone Creek and north and west of Deaddog Lake. These units appeared to be mostly monolithic dacitic lithic tuffs and lapilli-tuffs. Units containing tephra coarser-grained than lapilli are rare.

Clastic metasediments are found mostly on the southern side of the supracrustal belt, but minor interflow units of wacke and mudstone occur, scattered throughout the mafic flows. The metasediments are thickest in the areas west of Marsh Lake, where highly deformed polymictic paraconglomerates and coarse-grained wacke units form a high proportion of the stratigraphic sequence, and south of Hailstone Creek where the metasediments are biotite schists derived from muddy sandstones.

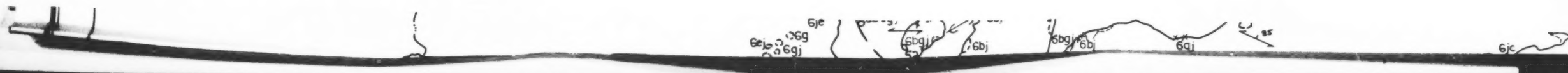
Chemical metasediments which give rise to appreciable positive magnetic anomalies occur just west of Deaddog Lake and between Senior and Fawthrop Lakes. The chemical metasedimentary sequence to the west of Deaddog consists of interlaminated magnetite-quartz ironstone and pure chert in close association with a thin sequence of dacitic rocks. The sequence to the west of Senior Lake is also predominantly magnetite-quartz ironstone and chert, but units of graphitic schist, pyrrhotite, and calc-silicate (consisting of amphibole and carbonate) also occur interlayered with them. These chemical metasediments are associated with fine clastic metasediments and intermediate tuff units.

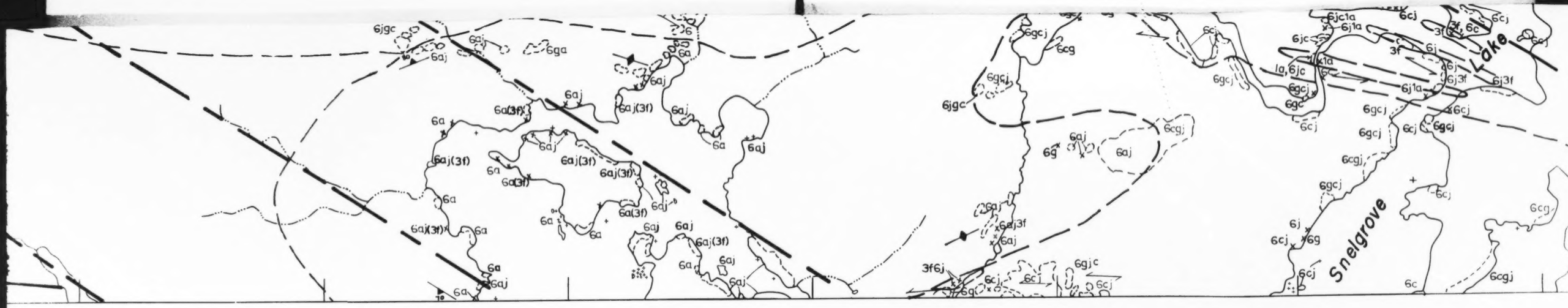
The mafic intrusive bodies between Senior Lake and Lake "A" consist mostly of massive medium- to coarse-grained gabbro and diorite. In a few places around Lake "A" minor sills and dikes of serpentinized peridotite cut the gabbro; in other cases, the ultramafic rocks appear to form part of the larger mafic bodies. Several outcrops of coarse-grained amphibolite occur in a small zone south of Deaddog Lake and in a fe places around Marsh Lake. These are classified as mafic metavolcanic but they can equally well be interpreted as gabbros.

The plutonic rocks in this area range from trondhjemite to granite in co position, and form several discrete zones which probably constitute se arate intrusive events. Biotite trondhjemite intruded only by late quart monzonitic pegmatite dikes is volumetrically predominant in the lar area around Gull, Christina, Fawthrop, and Deaddog Lakes; between Ferdinand and Snelgrove Lakes; and around Sesikinaga Lake. Sor hornblende-rich variations of the trondhjemite were also found arou Deaddog Lake. In the northeastern corner of the area, around Kez Lake, the intrusive history is complex; younger quartz monzonite a granodioritic phases are most abundant. An extensive zone of pegma tic biotite-quartz monzonite exists between the southeastern corner the project area and Hailstone Lake. The discrete pluton around Tarpl Lake consists mostly of massive pegmatoid trondhjemite to granodiorit Just west of Snelgrove Lake, there is a small body of gneissic biotit trondhjemite with concentric lineaments and foliation patterns.

Metamorphic rank in the supracrustal rocks appears to be medi grade (Winkler 1976), but no diagnostic index minerals were identified the field.

With the exception of a few areas, such as between Sesikinaga and Fe dinand Lakes, the outcrop density is high, probably averaging over 15 Quaternary overburden appears to be thin in all parts of the area. Wi minor exceptions. Most of the region is covered by sandy till, which places exhibits good glacial fluting, but there are few prominent surficia topographic features.





STRUCTURAL GEOLOGY

Minor Features

Nearly all of the rocks in the area exhibit planar structural and textural fabrics to some degree. For the most part these appear to be tectonically and/or metamorphically induced. Original bedding or layering was rarely distinguishable except in clastic and chemical metasedimentary units. Where this was observed, secondary foliations (*i.e.* schistosity, fissility, gneissosity, foliation due to flattening of pillows, clasts, etc.) in those rocks and surrounding lithologies were generally subparallel to primary planar structures.

Minor folds were rarely observed in the area, and few linear structural elements were noted during mapping.

Major Features

On the basis of bedding and foliation patterns, the local supracrustal rocks appear to be in a synformal configuration, with a relatively shallow westerly plunge. Facing determinations were made in only a few places, but these suggest that the fold is in fact a syncline.

As far west as Ferdinand Lake, trondhjemitic rocks have moderately well-developed cataclastic textures. These textures were induced by the effects of the east-trending faults seen in the southeastern part of the area. These effects are better developed just to the east of the project area, around North Bamaji Lake (Wallace 1979a, 1979b).

Many of the numerous lineaments shown on this map are probably faults, but in only a few instances can stratigraphic dislocations be demonstrated, given the scale of mapping and overall lack of lithologic variation.

ECONOMIC GEOLOGY

The only notable mineral occurrences found in the project area are molybdenum-bearing zones in and around quartz zones, shear zones, and pegmatite dikes. Showings at the southwestern end of Senior Lake (property 2) have recently been described by Sutherland (1978):

The largest of these showings is located at the entrance to the large bay in the north-central region of Senior Lake. It consists of a mineralized quartz vein that occupies the intrusive contact between a fine to medium grained 'felsite' to the south and a weakly foliated to unfoliated epidote biotite trondhjemite to granodiorite to the north. The 'felsite' is mineralized with fine grained, disseminated pyrite and is cut by tiny epidote stringers. Both of the intrusive phases are cut by minor dikelets of coarse grained to pegmatoid quartz monzonite. The quartz vein is about 20 cm at its widest and best mineralized location and it pinches out to the east and west. Molybdenite mineralization of locally up to 15 percent MoS_2 occurs as disseminations, banded disseminations, small stringers, and paint, primarily within the quartz vein with disseminated pyrite. Pyrite occurs in varying amounts over the entire exposed length of the quartz vein (approximately 25 m) but the presence of molybdenite is restricted to only about 5 m of the vein.

The two neighbouring outcrops to the north and south host small irregular quartz veins with minor disseminated pyrite, especially along the borders, and traces of disseminated molybdenite. The country rocks are the same weekly foliated biotite trondhjemite to granodiorite.

Two showings located north of Lake "B", southeast of Fawthrop Lake, have been referred to as the Ferdinand Lake Option of Madsen Red Lake Gold Mines Limited (property 1) by Sage and Breaks (1982). Both showings occur close to the contacts between trondhjemitic rocks and mafic amphibolites at the northern edge of the main supracrustal belt. In one of these showings coarse-grained clots of molybdenite, up to 1.5 cm across, are sparsely disseminated with minor pyrite within foliated biotite trondhjemite and concordant quartz and quartz-potassium feldspar veins over a strike length of at least 60 m. The highest concentrations of molybdenite, over 20% in places, were found in a narrow (1 to 2 cm) biotite-rich zone within the trondhjemite and in a quartz vein adjacent to that zone, which both strike at approximately N75°E. In the same immediate area, just south of the metavolcanic-trondhjemite contact, molybdenite was also found as disseminated patches up to 2 cm across in irregular quartz monzonitic pegmatite dikes up to 5 m wide, striking subparallel to the surrounding gneissic amphibolite. The highest assay value from this showing was 0.33% MoS_2 from a 0.6 m channel sample taken from trench No. 1.

The other showing, about 1 km to the west of the first, is in foliated trondhjemite about 100 m north of the metavolcanic contact. The trondhjemite contains fine-grained (< 2 mm), sparsely disseminated molybdenite flakes with pyrite, pyrrhotite, and minor chalcopyrite. Innes (1969, p.2) reported that these are found in an area roughly 200 feet by 100 feet. However, these are found over a wide area, but the mineralization is concentrated in and near irregular south-dipping quartz and quartz-potassium feldspar veins. As in the first showing, molybdenite is particularly concentrated in narrow biotite-rich zones along the contacts between quartz veins and host trondhjemite. Innes (1969, p.2) also reported the association of molybdenite with a flat- to shallow-dipping quartz vein in the same area. Although favourable values were registered during the trenching (best assay 1.15% MoS_2 over 2.1 m) subsequent diamond drilling proved generally discouraging (Diamond Drilling Reports 10 and 11, Assessment Files Research Office, Ontario Geological Survey, Toronto) and the option was discontinued in 1970. The best values obtained in 3 of 4 diamond-drill holes drilled normal to the structural trend of the molybdenite mineralized zones are as follows:

Hole No. 1 - 0.08% MoS_2 over 1.38 m.
Hole No. 2 - 0.96% MoS_2 over 0.64 m.
Hole No. 3 - 0.08% MoS_2 over 0.58 m.
Hole No. 4 - no values obtained.

RECOMMENDATIONS FOR FUTURE MINERAL EXPLORATION

Reconnaissance-prospecting will possibly uncover additional molybdenum occurrences, which are numerous in this region, particularly to the east of the project area (Sutherland 1978). Several minor occurrences were found by the field party in the Gull Christina Lakes area, and south of Ferdinand Lake. Like the showings north of Lake "A", the Gull Lake occurrences are located in trondhjemite quite close to the northern edge of the main supracrustal belt, suggesting some control of the mineralization. New occurrences should be checked for their gold, silver, copper, bismuth, and antimony contents.

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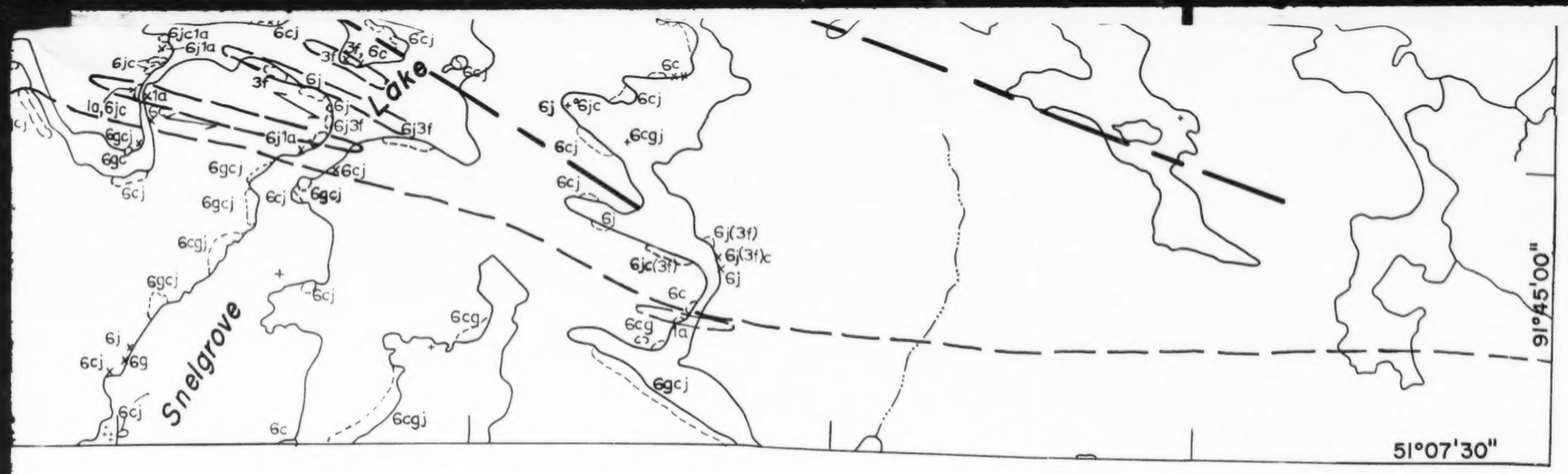

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